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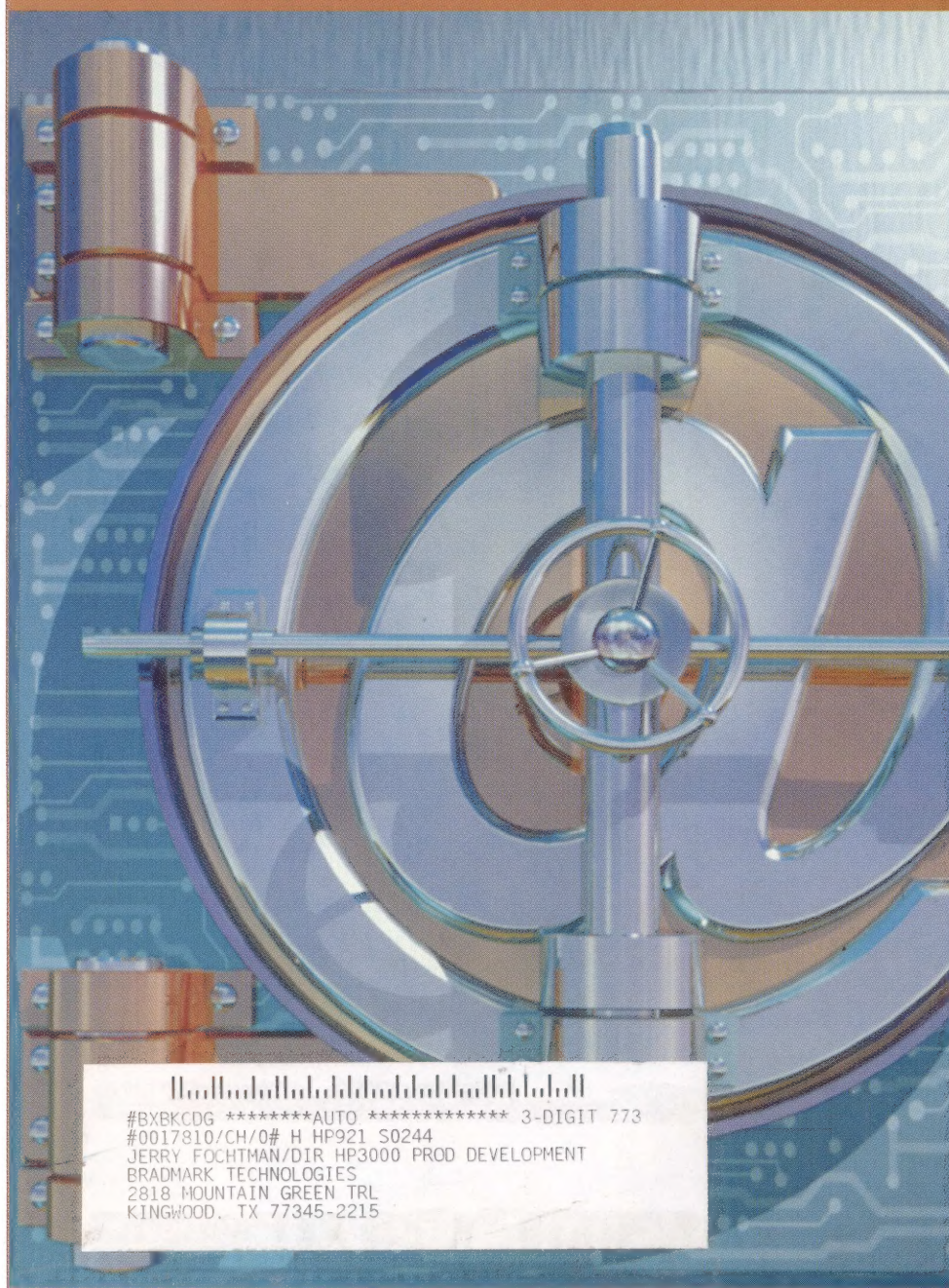
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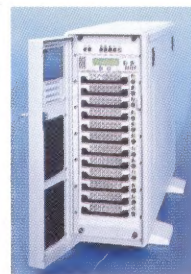
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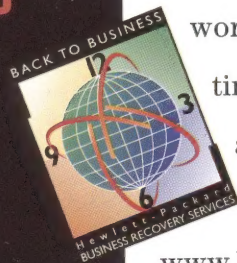
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ENTERPRISE STORAGE

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SANs to the left of you. SANs to the right of you. Storage Area Networks (SANs) are infiltrating the enterprise. So, it's not a matter of if, it's when. But which form will the I/O take in your environment? Will it be the appealing but expensive Fibre Channel or the less filling, but ubiquitous SCSI.

By Jeff DiCorpo and Jerry Namery

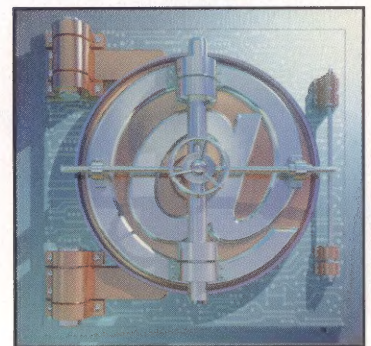
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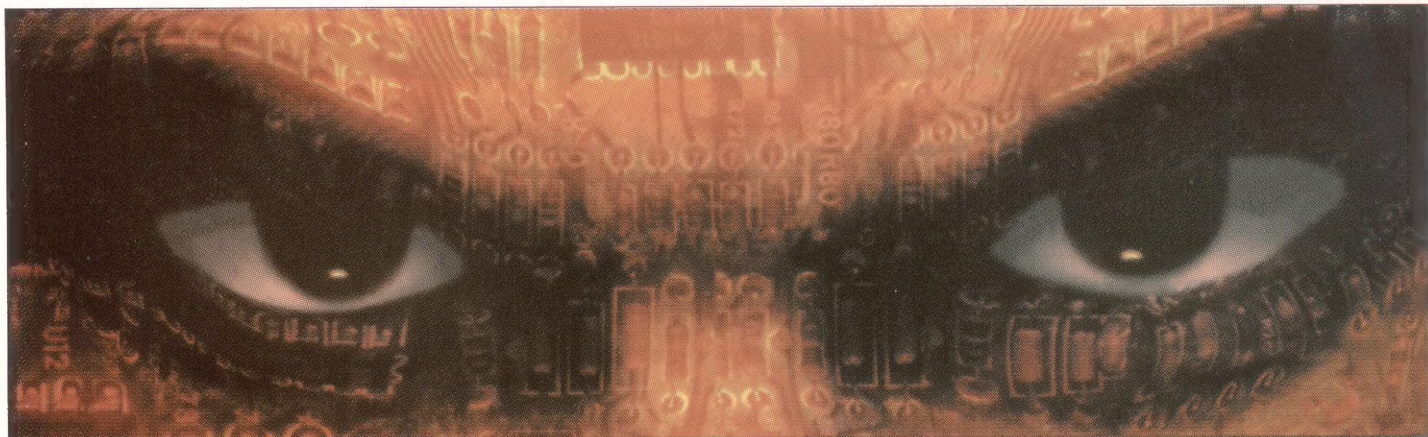
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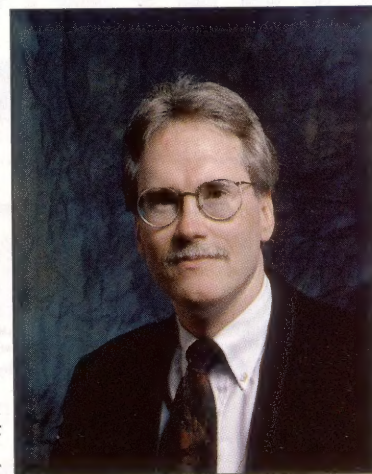
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Is Fiorina Getting The Lead Out?

Last month, I dusted off my “years view mirror” and took a look back at HP’s historical record. Spanning a good bit of the 20th century, it’s a record marked by enviable accomplishments. This month though, on the cusp of a new millennium, I can’t help but think about HP’s future.

HP’s future was also very much on the mind of Carly Fiorina during her keynote at Comdex last month; unless you’ve been living under a laptop for the past several months, you know that Ms. Fiorina is charged with plotting HP’s course into the next century. And quite frankly, she seized the moment. I know she did because I saw her keynote. No, I wasn’t actually there (not in person anyway), but I did “see it” over the Web, courtesy of RealAudio. At the same time, I was perusing news and financial Web sites, all of which were promoting their own unique perspectives on Fiorina’s performance; and waiting for a HP teleconference to begin. Perhaps not as good as being there, but one of my more positive Web experiences. Yep, I had the Web working for me. And as it so happens, that is what the new HP is all about too.

Like the President addressing both houses of Congress after 100 days, Fiorina lobbied the Comdex hordes with her state of the state of HP message. According to Fiorina, she spent her first 90 days in HP Labs. Maybe that is why she mentioned just about every buzz word and catch phrase that HP has attempted to use over the past several years — like “computing utility,” “information appliances” and “pervasive computing” — in failed marketing attempts to articulate a future in which one seemed particularly interested. Fiorina also made a passing mention to one of HP Labs’ most startling recent discoveries: the synthesis of the first molecular switch. That’s right — molecular. It doesn’t sound that radical, but it is. As Fiorina reminded the crowd, “everything with a microchip can be connected to the Web.”



A Brand
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Putting her appreciation of history to work, Fiorina pointed out that 15 years ago, Joel Birnbaum came up with the idea of “pervasive computing.” If you’ve been reading our interviews with HP executives or reading this page, the concept and implementation of “pervasive computing” is what HP calls E-services. — it’s HP’s radical idea of the moment. Think of it as a modern day “philosopher’s stone.” A quest — for HP and its partners at least — for turning the dross of the World Wide Web and the Internet into golden revenue streams. According to Fiorina, “we [at HP] live at the intersection of three vectors (maybe she spent too much time in the Labs) — services, [information] appliances, and infrastructure.” On Dec. 8, HP made e-speak, which defines the interaction between e-services, available at www.e-speak.net.

After the keynote, Fiorina introduced a new \$200 million global brand marketing campaign, which included a new HP logo. The new stylized logo is underscored by the word *invent*, which is perfectly in synch with Fiorina’s management vision: preservation (of HP’s proud history) plus invention (through a “culture of radical ideas”). So, whether you were in live or virtual attendance at Comdex, you missed the point if you thought Fiorina was talking about technology or about products. She wasn’t. It was all about culture: HP’s newly reinvented culture to be sure; but it was also about the future culture of the ‘Net. Her keynote captured the possibility of a ‘Net that does more than give you access to or assault you with information. Fiorina believes HP’s radical e-deas can help make the Internet work for people. I like that sentiment.

As I peer into my admittedly cloudy, crystal ball and into the next E-decade, HP looks less like a hardware company. Or a software company. Or a printer company. And looks more like a company inventing the future, rather than reinventing the past.

George A. Thompson
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Are You Open To A New Point Of View?

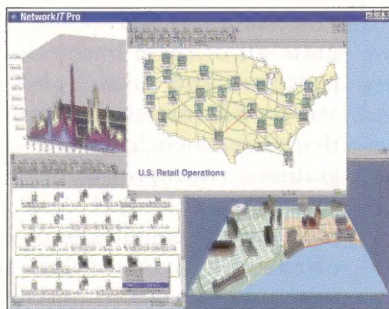
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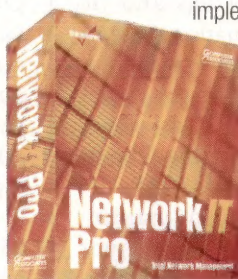
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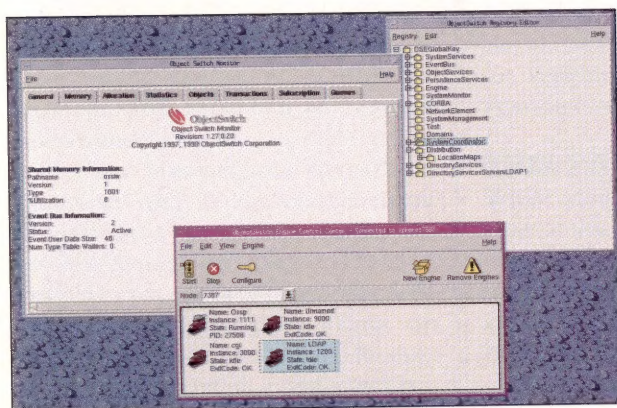
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Unix-based systems, particularly those running HP-UX, have traditionally functioned as backroom servers for the telecommunications industry. But with the convergence of voice and data networks, telecommunications vendors are looking to expand their solution offerings and tie existing information systems together with new technologies. ObjectSwitch, Inc. (Larkspur, Calif.), developer of version 3.0 of the ObjectSwitch Server for HP-UX environments, is one independent software vendor that hopes to give HP-UX administrators the tools to do so.

According to Doug Ehrenreich, director of industry marketing with ObjectSwitch, the ObjectSwitch 3 server environment provides a means for organizations to combine ser-

vices such as ATM, xDSL and Voice-over-IP with applications such as provisioning, billing and customer care — among others — to create integrated meta-applications running across public networks.

"We provide the ability to incorporate and abstract the computers, the networks and the databases into a common logical view. We can then take all of the disparate interfaces and make it simpler to manipulate them without reuniting developers to understand all of the inherent technology," Ehrenreich explains.

New in ObjectSwitch 3 server is enhanced support for software-based fault tolerance as well as the ability to hot-swap on-line applications. In addition, ObjectSwitch 3's support for UML-based object modeling and other enhancements makes it possible to develop new adapters and application interfaces at a lower cost.

Developers are often forced to create custom interfaces, but ObjectSwitch can abstract the difficulty of this process and allow programmers to code to one single interface standard. That approach has worked well for Chris Thornton, executive IT director with Gabriel Communications, a telecom-

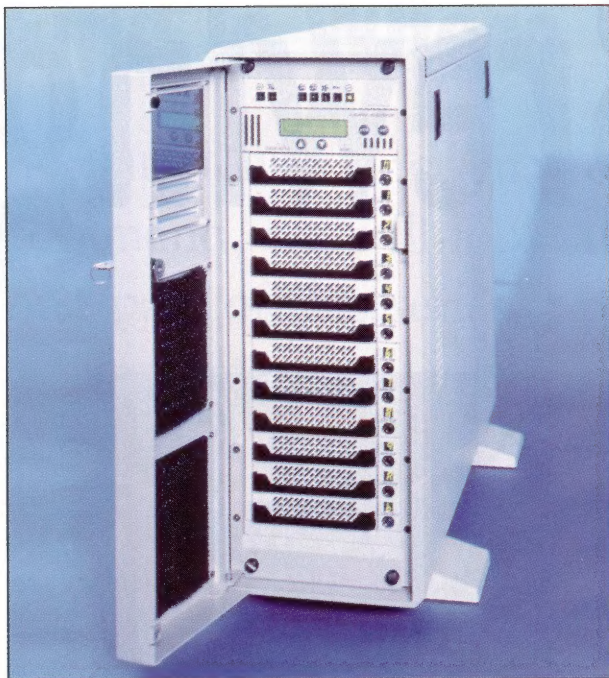
munications company using ObjectSwitch 3 server to transparently tie a number of disparate applications together on some new N-class boxes running HP-UX 11.x.

Thornton's problem cuts to the core of an emerging trend: Enterprise Application Integration (EAI): "We have several best of breed applications for our back office operations — including billing support, customer service and network inventory and provisioning. And we need to find a way to tie all of those systems together so that they can share information in a sort of near real-time environment."

"The problem with [EAI] is that everyone is saying 'Program to my API to integrate all of these business processes and rules,'" observes Ehrenreich, noting that ObjectSwitch 3's integration services provide one programmable API and abstracts the complexity of oftentimes diverse enterprise environments.

Thornton agrees: "ObjectSwitch provides the tools that allow us to build a solution that integrates all our applications, and it [does so within the context of] a completely programmable engine.

— Stephen Swoyer,
Contributing Author



Affordable RAID for HP-UX

Winchester System's flagship FlashDisk OpenRAID storage subsystem ships standard with 36GB Ultrastar hard drives from IBM Corp.

FlashDisk OpenRAID is positioned as a plug-and-play storage solution that appears as a standard Ultra2 SCSI subsystem to the host machines. This eliminates the need for proprietary host software or RAID managers. The FlashDisk OpenRAID storage subsystem supports several kinds of hardware RAID, including RAID 1, 3, 5 and 1+0. Namery says that his company's support of RAID level 1+0 is largely driven by customer demand.

FlashDisk comes in several different storage configurations, including the entry-level FlashDisk OpenRAID Desktop, which contains 145GB of storage in a one-foot cube. FlashDisk OpenRAID Enterprise, the company's flagship storage subsystem, offers 2.3TB of storage and can support up to 36 simultaneous hosts. All FlashDisk models include call-for-help hardware paging and can be managed using TELNET, HP OpenView or IBM NetView.

According to Chris Ledoux, IT director with Brooktrout Technology Inc., a vendor of electronic mes-

saging products for telecommunications and networking environments, Winchester System's direct sales model really helped to distinguish it from its larger, more visible competitors.

"We had quotes on EMC and also a [Data General] Clarion solution and we didn't even bring them in for evaluation because the pricing was too high," say Ledoux. He first looked to implement a FlashDisk OpenRAID-based solution as a means to remedy persistent performance problems with his company's Oracle financial applications running on an HP storage subsystem.

"It was performance problems with Oracle applications that we were running on an HP-UX box. We had concurrent jobs that were taking seven minutes to run, such as creating purchase orders, and that kind of thing."

According to Ledoux, the FlashDisk OpenRAID storage subsystem provided "an across the board improvement in performance." Those same concurrent jobs are now taking seven seconds.

FlashDisk OpenRAID storage subsystems are supported on versions 9.2 and higher of HP-UX.

— Stephen Swoyer,
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Statistics tell us that the cost of storage has plummeted in recent years, but to many in the HP-UX world, scalable storage still seems anything but affordable. Jerry Namery, Winchester Systems' Chief Technology Officer hopes to change all of that. By leveraging a direct sales model Namery says that his company can sell storage subsystems at lower price points and tailor them to the needs of HP-UX customers.

"We have a direct sales model similar to that of Dell," Namery says. "With an EMC system, for example, the reality is that the system [that a customer buys] is usually more than they need. And with an HP solution, HP isn't even making the product in the first place, which can add to the cost."

What's Brewing

Fibre Channel-based Storage Area Networks (SANs) are the newest-fangled fad among storage vendors. Early Fibre Channel adopters argue that networks built on FastEthernet and Gigabit Ethernet are not fast enough. Fibre Channel proponents also argue that SCSI, a short distance technology, just can't cut it in the datacenter. And LANs? Forget about it. They are too high-latency. Jeff DiCorpo, HP's Storage R&D Project Manager takes up the Fibre Channel cause in part one of our feature article this month.

But don't throw out the SCSI with the bath water just yet. In fact, you should be dusting off those SCSI drives because the days of SCSI-based storage are far from numbered, according to Jerry Namery, Chief Technology Officer at Winchester Systems Inc. SCSI does SAN without multi-initiators and is interoperable between all vendors. And unlike Fibre Channel, SCSI is backward and forward compatible with itself.

Fibre Channel. SCSI. Fibre Channel. SCSI. Check out both sides of the issue and discover which one leaves you with a great taste and which one is less filling.

George A. Thompson
Editor-in-Chief



In Storage?



***Jerry Namery, Chief Technology Officer
at Winchester Systems Inc.***

The Facts On Fibre Fictions

EVERY NEW INTEL PC SERVER and workstation made today (regardless of price) come standard with one or two 80MB/sec Ultra2SCSI ports, usually included on the motherboard. And that single PCI card supports 30 disk drives. By adding a single PCI card to a server or workstation with dual 80MB/sec Ultra2SCSI ports, you get an additional 160MB/sec peak throughput or about 142MB/sec sustained; speeds which are considerably faster than what Fibre Channel offers.

Also consider that all high-performance disk drives from every vendor come in 80MB/s Ultra2 SCSI configurations, at nearly the same price as the slower SCSI models. And that's not all. The industry is rushing to complete yet another doubling in SCSI speed: this time to 160 MB/sec per port. Called Ultra160/m, without changing cables or connectors, the doubling in data transfers will be done at the same 40MHz clock speed but by double-clocking the data. This means that both the current 80MB/sec Ultra2SCSI devices and the new UltraSCSI 160MB/sec devices will operate at full rated speed on the same bus. By late 1999 nearly all SCSI disks and Intel-based servers will come standard with Ultra160/m port. With that in mind, let's review the myth-conceptions about Fibre Channel.

Jeff DiCorpo, HP R&D Project Manager

When The SANs Come Marching In

STORAGE AREA NETWORKS (SANS) borrow an idea from mainframe-based data centers, where a network storage interface called Enterprise Systems Connection (ESCON) has been used for years to connect mainframe computers to multiple storage systems. On distributed networks, the same concept has been applied to isolate backup and recovery functions from the main backbone network, saving scarce bandwidth on the production system and allowing a far greater degree of control and manageability on the backup and recovery network.

Realizing the benefits of SANs, while recognizing the need to develop a standardized approach for distributed storage area networks, more than 50 storage and networking vendors formed an industry consortium called the Storage Networking Industry Association, or SNIA, in late 1997. The group's charter is developing specifications for a set of standards for SANs and network-attached storage (NAS) devices. In the short term, the SNIA is focusing on developing a set of standardized interfaces suitable for LANs, enterprise networks and WANs. The most promising technology seems to be Fibre Channel, an enhancement for the SCSI bus attachment favored by the industry consortium as well as by early adopters in the user community.

Fibre Channel will solve all your I/O bandwidth problems. Some vendors of Fibre Channel claim that 100MB/sec port bandwidth is so fast, users will never wait for I/O again. That may have been in 1996, when the fastest I/O bandwidth per host adapter was an UltraSCSI at 40MB/sec. But today's SCSI standard offering provides at least 60% more bandwidth per PCI host adapter at a lower cost, most users select higher bandwidth.

Fibre Channel lets you put up to 126 hosts and storage devices on one loop.

Users find that to maintain reliability they should limit the number of drives per loop to a few dozen. Otherwise they may experience hung loops or even lost data. The problem may stem from Fibre Channel arbitrated loop arbitration (FC-AL) or because every drive must pass the loop to the next. So, the advantage of Fibre versus SCSI may be lost: one new PCI adapter with dual Ultra2SCSI supports 30, about the same as Fibre Channel.

Fibre Channel is faster for all applications.

Fibre Channel storage is not well suited for most business applications because FC-AL arrays usually require the host to perform RAID 5. Using any host-based RAID 5 is unacceptable to most users of high performance servers because reliability and performance are dramatically reduced over hardware RAID 5. In general, Fibre Channel storage has been well received by users of video and imaging applications where host-based RAID-0 or striping is acceptable. In these applications, users like the ability of Fibre Channel to support longer distances and run over fiber optic cables.

Fibre Channel is more reliable than other storage options.

Fibre Channel drives run up to 50% hotter than identical SCSI drives. In addition, Fibre Channel is a network protocol that relies on Class 3 data transfers, which means coping with lost data packets. Because Class 3 service relies on the application to recover from a lost packet, the result to users' data may be catastrophic. Today's applications were written to support reliable SCSI data transfers. SCSI is a parallel bus technology, similar to the busses that make up all computer systems, and every transfer is guaranteed and acknowledged with proper handshakes. Fibre Channel is a serial data channel designed to deliver 1-Gigabit of information over long distances without the necessary hardware error recovery.

Consider that all high-performance disk drives from every vendor come in 80MB/s Ultra2 SCSI configurations.



SANs borrow an idea from mainframe-based data centers with a network storage interface called Enterprise Systems Connection (ESCON).

A Fibre Channel SAN consists of a number of servers and storage subsystems connected through a high speed hub or switch. Fibre Channel offers several important benefits: Running at up to a gigabit per second (Gb/s), it breaks the SCSI barriers in both speed and number of simultaneous users. Fibre Channel, designed from the outset for low-latency storage area networks, offers superior speed and performance. It scales well by allowing users to add storage capacity without needing to reconfigure servers. And it's also manageable as a separate element within the overall network fabric, promoting quicker fault recognition and error correction.

Fibre Channel connections can span up to 10,000 meters, or more than six miles, allowing servers and storage devices in today's widely dispersed campus environments to participate in the SAN without the need to build a wide area network. And, perhaps most important, Fibre

Channel is based on a set of open ANSI standards, simplifying connection and expansion. Key to enabling companies to evolve effective backup and recovery strategies, Fibre Channel SANs also resolve the bandwidth crunch problem.

By running servers and storage devices on an essentially closed system, network managers are able to use the SAN as the backup network, even as users continue to tap into network-based information over the conventional backbone. This capability meets full-availability requirements while allowing administrators to back up vital data as often as needed to ensure a quick restart in the event of a catastrophic failure.

While Fibre Channel seems to be the choice for storage networks among early adopters, alternatives still exist: primary among them SCSI and traditional LANs. However both of those choices suffer in comparison to Fibre Channel, though, particularly when used to incorporate data backup and recovery as a core SAN element.

SCSI. Running at 40Mbps, SCSI is attractive for several reasons: it's low cost, it can carry a large amount of data and it's a low-latency medium. It's also mature and well-understood by systems architects and network administrators around the world. Studies show SCSI is used to connect nearly 90 percent of overall organizational storage today.

But SCSI has distinct limitations: it's a short distance setup; SCSI buses span less than 200 meters. And it's not suitable for large networks; SCSI can only support 16 total devices. SCSI is also inherently unsuitable for shared implementations; unlike Fibre Channel, SCSI is optimized to attach multiple storage devices to a single server.

LANs. LANs also have several attributes that make them



Fibre Channel is finally mature and interoperable.

Interoperability is even a problem between different equipment of the same vendor. And in most cases, changing one parameter like the host OS or the application or the cable length may cause problems.

Several large vendors, notably Quantum and Adaptec have recently exited the Fibre Channel market due to interoperability problems. Both these vendors announced their intention to focus all their energies on Ultra2SCSI and the upcoming Ultra160/m standard.

Fibre Channel storage is very similar to SCSI-based RAID arrays.

Most Fibre Channel arrays sold are actually "Just a Bunch Of Disks" or JBOD. And most users of Fibre Channel use them in JBOD or host-based RAID 0. This is because vendors found it extremely challenging and expensive to make Fibre Channel hardware RAID work. SCSI-based hardware RAID arrays have been the staple of the storage industry for nearly every server requiring more than a few drives for the past five years. The technology of SCSI is stable and well-understood.

Fibre Channel is the open standard for the future.

This may be the case, but users' investment in current Fibre Channel may not be protected. The first Fibre storage arrays were introduced by Sun in 1994 based on quarter-Gigabit technology and are only supported on Sun S-Bus servers. This technology is obsolete. And today's 1-Gigabit Fibre Channel arrays are not interoperable with this old standard.

Vendors are now considering a 2-Gps or faster standard for Fibre Channel, but there will be no ability to use the current Fibre Channel drives, hubs, switches or possibly even cables with this new standard. With today's Ultra2SCSI, disk arrays can be plug-and-play backward compatible all the way to SCSI-1 of 1984 and forward compatible to Ultra160/m and possibly beyond, which ensure investment protection well into the next five years.

Fibre Channel easily supports multi-hosts to form a SAN.

Without very expensive fibre switches, adding multiple hosts to one Fibre Channel loop is tricky because the host-software doesn't support multiple initiators. Often each host will attempt to reset the channel to gain complete control, which can result in even more lost packets and a hung bus.

SCSI Is As SCSI Does

SCSI is ...

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- ...backward AND forward compatible with itself. Fibre Channel is not.
- ...interoperable between all SCSI vendors.
- ...the de facto standard in every OS, every server, and every workstation.
- ...available from many vendors.

SCSI does ...

- ...true hardware RAID easily.
- ...SANs now — without multi-initiators.
- ...protect your hardware and software investment with backward compatibility.
- ...your business applications much faster.
- ...provide your business applications with reliability.

For more information: www.scsita.org (The SCSI Trade Association) — J.N.

attractive to IT managers. They're capable of spanning long distances and connecting thousands of devices. They're already in place virtually everywhere, so the capital outlay necessary to add a SAN — rather than build a separate Fibre Channel network — is lower. LAN-based storage doesn't require that IS staff learn the intricacies of a new interconnection method. Ethernet, FDDI and Token-Ring have been around for decades and are well-understood by technicians the world over.

Designed for general purpose networks, rather than as high I/O systems LANs simply can't operate at the necessary speeds to meet SAN requirements. Even next-generation high-speed LAN technologies suffer from the overhead created by the TCP/IP protocol stack. In the case of Gigabit Ethernet, the administrative requirements begin to eat up the added bandwidth, making it unsuitable for use as a dedicated backup and restoration storage network.

In the absence of a dedicated backup loop, network administrators have two options when backing up servers and storage subsystems: use the network or attach a separate backup system to each device. As noted earlier, bandwidth on even the fastest production networks is insufficient to support normal operations and system-wide backup simultaneously.

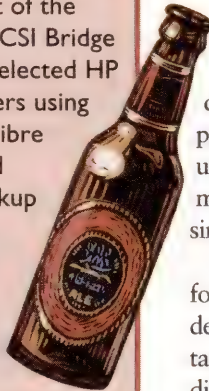
Attaching a backup system to each storage device is both expensive and difficult to manage. The hardware is costly, as are the salaries of sufficient staff to load and unload tapes, manage each backup device and handle hardware or software faults. In contrast, centralizing backup to an automated tape library system on a Fibre Channel SAN, even assuming additional costs for building the infrastructure, should result in substantial hardware cost savings. According to some estimates, centralized backup should be less than half as expensive as the directly attached backup model. And the benefits of automated centralized backup — realized immediately in lower staffing require-

Back Up To Fibre Channel

To give customers a complete Fibre Channel-based backup and recovery solution that allows them to share a tape library among several servers and attached storage devices, HP is now offering a Fibre Channel-based backup solution. A primary component of the solution is the HP SureStore Fibre Channel SCSI Bridge 2100, which provides connectivity between selected HP automated tape library systems and NT servers using HP's Fibre Channel host bus adapters. HP's Fibre Channel products offer the first steps toward building a dedicated Fibre Channel-based backup loop. In addition to the servers, SCSI bridge, tape drives and host bus adapters, users will need a Fibre Channel hub to handle connectivity for the entire SAN.

Along with the hardware components of the Fibre Channel tape solution, HP will provide Fibre Channel-aware software from leading backup application vendors, which will control all backup activity, including automated scheduling, remote device administration and fault management. The primary requirement for "Fibre Channel-aware" software is managing shared access to the tape library system among all the servers on the loop.

At this time, HP's Fibre Channel solutions are available for use on servers running Microsoft Windows NT 4.0 only. HP plans to support additional server operating systems as its backup software partners make applications available. As Fibre Channel technology evolves, future tape library systems will include the technology necessary to attach directly to a Fibre Channel SAN. Currently, external bridges are the best available solutions but, in the near future, vendors such as HP will bring automated tape library systems to market with internal Fibre Channel interfaces. —J.D.



In comparison, several vendors make SCSI hardware RAID arrays with multiple independent SCSI host ports. This allows attaching several servers to one array, each on their own private SCSI bus. This completely eliminates the multi-initiator problem. Although it's not designed for long distances, SCSI goes the distance most users need in computer rooms: 25 meters point-to-point (one host adapter to one storage array). Using SCSI hardware RAID arrays, users have no limits to how much SCSI-attached storage they can add to any server.

Jerry Namery is Chief Technology Officer at Winchester Systems Inc.

ments, improved reliability and streamlined administration and management — will more than offset infrastructure costs.

Server clustering has become popular as a means to achieve high availability without the expense of deploying fault tolerant redundant systems. Clustering, however, complicates the process of backup and recovery. Clusters are inherently dynamic; responsible for managing data and applications moves from server to server as needed to keep the system running.

At present, the most secure way to back up clustered data lies in the direct-attached SCSI model. With the anticipated arrival of cluster-aware backup software and intelligent use of tape backup systems, the industry is moving toward a model in which multiple clustered servers can back up to a single group of Fibre Channel-attached tape drives.

Larger multi-server organizations favor centralized backup for data consistency and easier restoration. Ideally, data storage devices, such as disk and tape subsystems, would take advantage of a separate storage loop that connects widely dispersed disk space with central backup systems. Some networked storage architectures rely on WAN links for backup and restoration of archived data. Several issues affect this approach, however. Among these is reliable access to WAN links, especially those based on public networks, and data-transfer rates over WAN links as compared with local connections.

Trends toward solutions such as data warehousing and "server farms" beg for data storage consolidation, which can provide greater central manageability and faster repair times. As a result, many users are combining centralized placement of application, storage and back-up servers with WAN-based client access, rather than linking storage or backup servers over those same links.

To realize fully functional Fibre-Channel-based wide area storage networks, some issues need to be resolved. To move from localized arbitrated loops to corporate-wide storage networks requires Fibre Channel switches and routers to create a "fabric" analogous to high-speed WAN topologies.

Also, an infrastructure for managing storage on the SAN, independent of the servers accessing it, needs to evolve. Software will provide a framework for a number of storage management capabilities: redundancy for high availability, replication for performance, remote vaulting and backup for data protection, heterogeneous access, and migration of data to and from near-line and off-line repositories.

SANs based on Fibre Channel technology offer IT managers and network administrators a fast, efficient alternative to traditional SCSI- or LAN-based storage and backup models. By the end of the century, Fibre Channel SANs will take their place alongside traditional LANs and WANs as indispensable components of enterprise information systems.

Jeff DiCorpo is the Storage R&D Project Manager for Hewlett-Packard.

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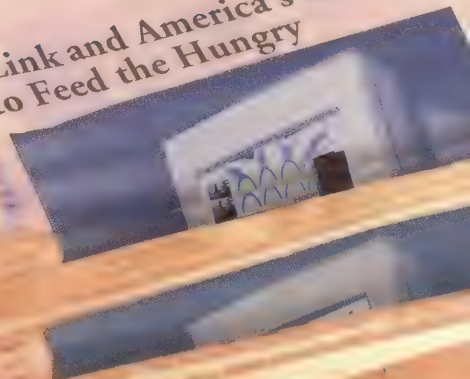
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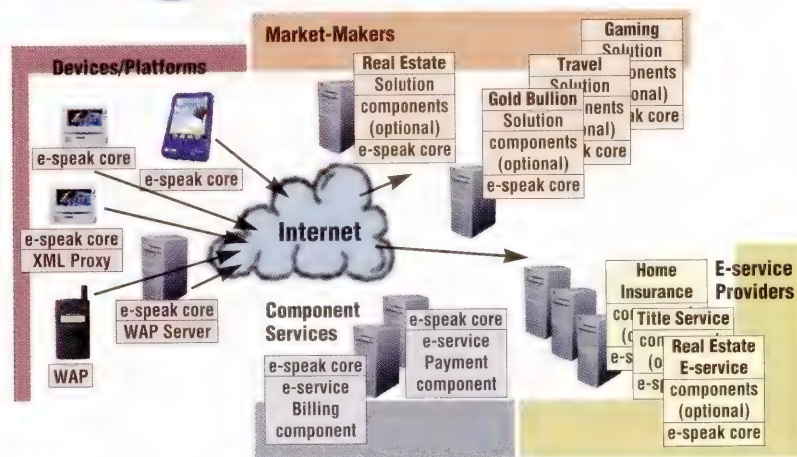


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About three weeks into HP's fiscal year 2000, Carly Fiorina got into the spirit of the new millennium with a Comdex/Fall '99 keynote that should be viewed as nothing short of inspirational. Ok, I know Comdex keynotes are mega-marketing opportunities to sell your firm's technology — not exactly the time to be talking about the culture of the 'Net' (see my editorial on page 4

George A. Thompson Editor-in-Chief

in this issue). However, if nothing else, Fiorina displayed the characteristics of the CEO and president she has already demonstrated herself to be in her first 100 days on the job: dynamic, thoughtful and assertive.

Fiorina also left a good taste in Wall Street analyst's mouths the next day by closing out the last quarter of fiscal 1999 with a 10% growth in revenue and by beating their collective earnings estimates by a couple of cents. That's not too bad for the newbie CEO of America's fourteenth largest corporation amidst the frenzy of eye-popping IPOs. But the question remains, will that be enough? If you have any doubts, Fiorina has already established a challenge for HP's fiscal Y2K: 12% to 15% revenue and profit growth.

While paying homage to HP's legendary founders during her keynote, she noted that HP needs to move beyond personalities and even technologies. For Fiorina, the next millennium is about culture. "A radical culture of ideas" — for companies and for customers. Radical enough to transform a cold, cruel cyberculture into one that is — to coin a phrase — kinder and gentler. For example, The Fortino Group (Pittsburgh, Penna.) claims the average Internet user will misfile 120 pages of information and mislog 33 folders every month; and will spend over two years and nine months lost somewhere in cyberspace.

The warmer and friendlier vision of the 'Net will presumably favor HP and its partners as product and ser-

vice suppliers. But all cynicism aside, HP's vision of "The next E" is taking shape — both inside and outside of HP. Fiorina has already, in her own words, created an "ambidextrous organization — one that is positioned to make smart trade-offs based on a clear view of the big picture." To that end, she reorganized HP to focus on "two big investment bets for growth:" e-services, for which Ann Livermore and Duane Zitzner are now primarily responsible; and digital imaging and digital media spearheaded by Antonio Perez and Carolyn Ticknor.

But executive reorgs are nothing new at HP. So, just what kind of radical HP is Carly Fiorina creating for the 21st century? Well, if her Comdex keynote was any indication, I think you'll find it in this quote: "The really successful companies ... create synthesis that can marry the best of the old and the new, of the dot-com and the brick and mortar, of the young Turks and the old guard. It's about the art of balance, the art of synthesis."

Fiorina also knows that HP is well-respected for its spirit of collaboration and partnership. "HP, is a better partner, a better collaborator than any other company in the technology information industry today,"

she boasted. If you're an HP partner, you know there's truth in that statement. But if you're going to be a successful partner with HP in the future, you better be ready for some radical ideas. Here's one: Fiorina believes "this the end of the pure product era. It's not that products aren't important. The money, the profit, the revenue, no matter what kind of company you are, no matter what you sell, the money is going to be driven by services."

If you're an HP partner, you should be getting a clue right about now. HP's E-services vision is currently taking root: On December



"[HP has] deep engineering prowess. I bring strategic vision which HP needs." *Fortune Magazine* interview (October 25, 1999)

8, HP released its e-speak source code (available at www.e-speak.hp.com). And if you remember HP executives talking about "pervasive computing" and the "computing utility" then you know that long before Fiorina was named CEO to replace the venerable Lew Platt, HP has been busy putting the e-pieces in place.

Fiorina is busy connecting the e-dots in dot.com: "Profit is in the intersection of e-services, appliances and of infrastructure. Revenue comes from wrapping services around products. And third, it's culture, certainly as much as and probably almost more than technology, that

is going to help the Net deliver what people want. And it's going to take the 'Net out of Cyberspace and bring it to the family."

However, Fiorina is keenly aware that HP employees alone can't bring the vision to life (see sidebar below). Everyone must get involved, especially HP's key ISVs like Baan and Oracle among others, HP Channel Partners, integrators and consultants.

That's why we created this Vision 2000 supplement. On the following pages, you'll read about the companies that are already part of the new culture of radical ideas. So, as you read about the products, strategies and plans for the next millennium decide for yourself if you want to be part of that kind of culture too. ♦

Creating Communities With E-Services

E-services affords us the opportunity to create communities, for example communities of people who are in need of a service for people who can deliver that service. One example of an e-service at work makes me particularly proud, because it's an example of the Net being now used, not to create IPOs, not to create market cap. It's an example of the Net being used to solve fundamental problems, in this case, hunger.

You have probably heard of America's Second Harvest. They are the largest hunger relief organization in the country today and HP has recently built an e-services portal for them, which we call Resource Link (www.resourcelink.org). And what Resource Link does is connect food producers, who in many cases have food spoiling, and other donors to organizations that feed the hungry. So, at Resource Link, one e-service matches donors, or sources with excess food that would otherwise go to waste, with charities that provide it. Then, another e-service, National Transportation Exchange, identifies shipping companies and distribution links so that

the food can be distributed at low or no cost.

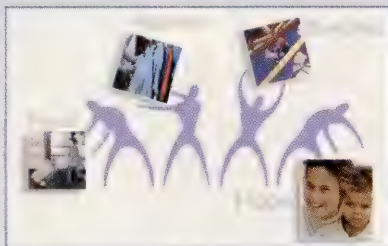
The first day that Resource Link went live, more than 1 million pounds of food were donated and the program gains momentum every day. I'm honored, truly that HP had the opportunity to work on a project that applied technology to solve such a basic fundamental problem. Hunger is about as basic as you can get.

The e-services came out of HP and HP labs. E-Speak, the technology that created communities

between donors and distributors and hungry people that I talked about, came out of HP Labs. The bulletproof, mission critical, server technology behind Resource Link came from HP. It's a great example of thinking about the intersection [of services, appliances and infrastructure].

And maybe if every technology application could have this significant an outcome, it might inspire all of us to think along broader lines about how to make the Net more useful.

Editor's Note: The preceeding is excerpted from Carly Fiorina's Comdex/Fall '99 keynote address, November 15, 1999.



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"To succeed, Internet projects must be linked to overall strategy and encompass the full value chain."

The race into the 21st Century is well underway, and as we move into the new millennium, the proliferation of the Internet will continue. Leading industry analysts report that e-business transactions could reach more than \$1.3 trillion by 2001, driving HP users across all industries to implement new e-services solutions and enhance their existing enterprise initiatives to include the Web.

While this may sound straightforward, Internet projects are complex and often underestimated. Recent research reveals that as many as 75% of e-business projects may fail due to a lack of understanding of the technology involved and poor strategic planning.

Effective e-solutions involve much more than designing Web pages. To succeed, Internet projects must be linked to overall business strategy and encompass the full value chain – from electronic storefront, through internal/external partner relationships, to back-end legacy integration. This requires an array of outside partners, the sum of whose capabilities outshines what any single vendor can bring to the table.



The Short List of A-Players

In addition to our traditional market dominance as HP's largest Enterprise Reseller, and our relationships with Cisco, EMC and others, Forsythe's e-services may incorporate solutions from Internet powerhouses such as Ariba, BEA Systems, BroadVision, Clear Commerce, I2 Technology, and Oracle.

By bringing these key partners to our customers we are able to offer end-to-end e-business solutions. Our existing strengths in the key infrastructure areas of mission-critical computing, storage and security, and our experience in e-services management form the foundation for successful Internet strategies. By excelling in these core competencies and offering our customers the necessary professional consulting services, we are able to ensure that things will work as planned, on time.

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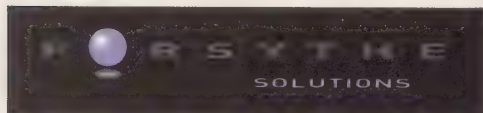
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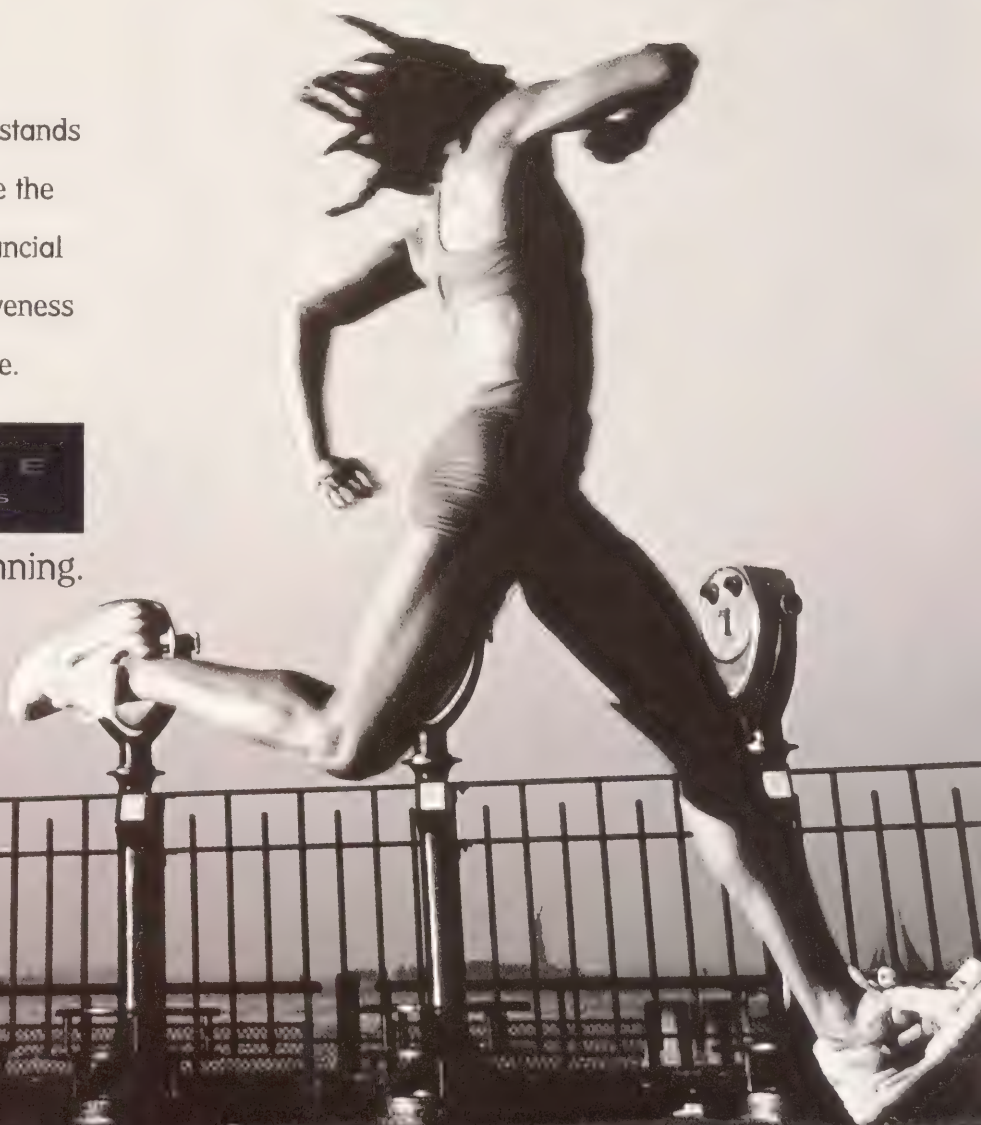
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Bradmark brings the HP 3000 'Back to the Future'

Bradmark's Y2K vision brings fiscal soundness back to the computer industry by developing products that allow the user to evolutionize rather than revolutionize.

Over the last few years we have seen a lot of change, not only in the HP 3000 community, but also in Hewlett Packard in general. Going into the year 2000, HP is riding a new wave. Carly Fiorina is the first female CEO at Hewlett Packard, and she is the first CEO not to have been promoted from within the ranks of the HP organization. This is definitely a major change in the behavior of Hewlett Packard. There is no doubt that HP is willing to break tradition to allow the company to move forward into the new millennium.

At Bradmark, we haven't been quite so bold. Our vision is directed toward technology rather than organizational structure. Since the 1991 Interex Conference (now HPWorld), HP has tried to overcome the perception that they're phasing out the HP 3000. In its enthusiasm to promote UNIX, it left the HP 3000 user with the feeling that the entire company was moving to UNIX, and as a result, abandoning the HP 3000, its trusted and most reliable system. In contrast, I would like to think that with the advent of the new UNIX servers, HP was just broadening its horizons.

We are trying not to make that same mistake. Yes, we have expanded our product line into the UNIX and NT markets to support the new relational databases of Oracle, Sybase, DB2/2, Informix and Allbase; however, we have also continued to develop new features (as well as improve older features) within our HP 3000 product lines.

Today, our flagship product, DBGeneral, processes capacity changes, detail set reorganizations, and database structural changes in a fraction of the time it did 5 years ago. With the movement to client-server and e-commerce, databases are experiencing exponential growth. Therefore, our goal for the new millennium version of DBGeneral is near zero-downtime.

Since 1990, everything has been directed towards getting rid of the old and going to the new, at a considerable cost. The problem is, there is nothing really wrong with the old. Both the systems and the database technology are faster and more reliable. And, the communications capability is just as good; so what has been gained by going to a new system? I guess the quest is a final attempt to arrive at a universal operating environment.

The Open Systems movement, which was the industry's attempt to form a common standard over which all future systems would be modeled, turned into a movement to sell UNIX boxes, professing UNIX as the new universal operating environment. Well, ten years later, UNIX has just turned out to be just another operating system, and a proprietary one at that. IBM is still sell-

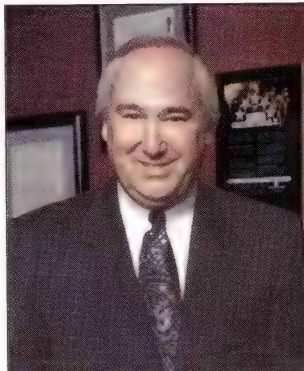
ing mainframes; the NT market is going gangbusters; AS/400 is doing great; Linux is skyrocketing; MPE is a contender to the mainframe; and, VMS systems are still supporting corporate America.

What disturbs me the most about all of this, is that many innovations should have been done on the HP 3000 – at a considerable savings to the IT budget. The only thing that makes the HP 3000 look old is the command-line operating system. This, however, is easy to resolve.

By placing a graphical front-end onto MPE, it looks like all the other state-of-the-art systems, and you didn't have to buy a new system to get there. There is nothing wrong with innovation, as long as it can be incorporated into the current environment. For this reason, we developed the Command Center 2000 and WinMPE for the HP 3000.

Minimizing risk is also an important consideration in any change. The implementation of new technologies has resulted in the rapid rise of IT project failures, because we've implemented new technology on top of new technology, rather than leveraging stable platforms.

Bradmark's Y2K vision is to bring fiscal soundness back to the computer industry by developing products that allow the user to evolutionize rather than revolutionize. Bradmark's philosophy is to bring the better concepts of the open system environment into the world of the older, proprietary systems, like the HP 3000, while still supporting UNIX and NT technologies.



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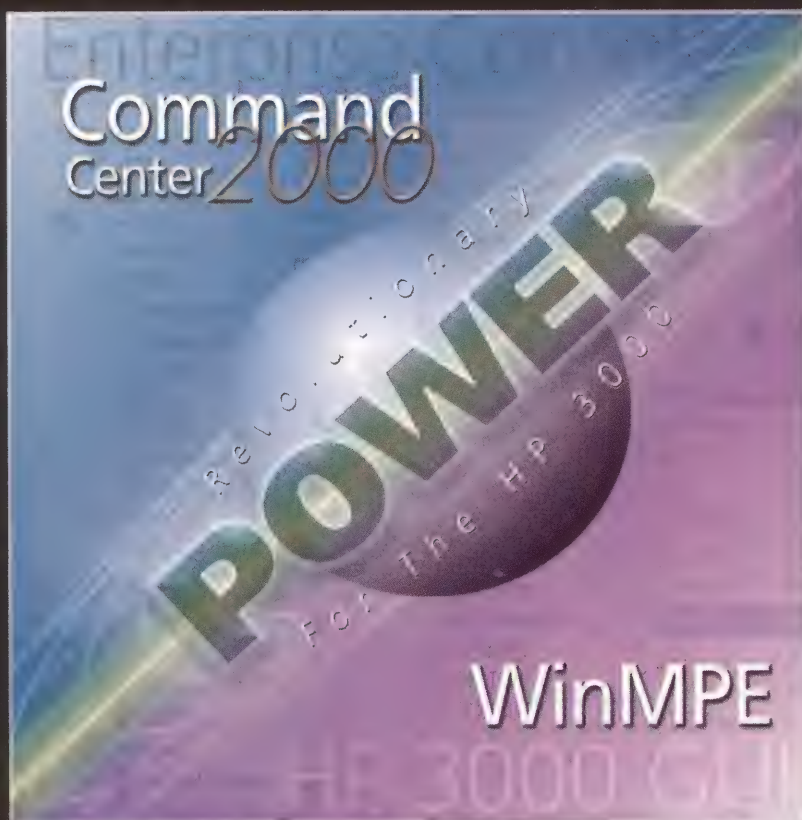
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Shawn Gordon, The 3000 News Wire, September 1999



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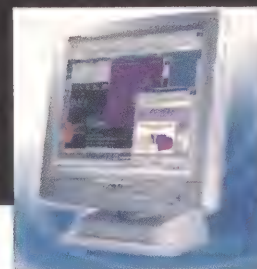
Command Center 2000 accomplishes, from a single-console window, the daunting tasks that System Management faces when working in the character-based HP 3000 MPE/iX operating environment.

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HP OpenView E-Services Management

IT management in the new millennium requires successful management of the "E-World"

BY MAUREEN MELLON

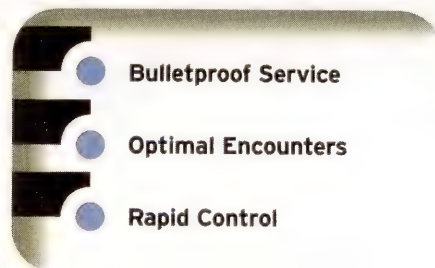
With competition just a mouse-click away, loyalty is measured in seconds and perception is the only reality.

Forrester estimates that by 2002, 82% of US firms with more than 1,000 employees will be doing business online and by 2003, business to business e-commerce will reach \$1.3 trillion. Clearly, the stakes in the "e-world" are high. The daunting task of transforming this untapped business potential into profit lies in the hands of the IT organization, which in the past has supported the business and today must help lead the business.

When I talk with customers, I hear a consistent set of concerns: "It's a struggle to keep pace, how can I keep up with the demand for new services? It was hard enough to keep our internal users satisfied, now I've got to worry about external customers and our suppliers. How can I ensure that our e-business is successful?" For most of these customers, the vision is clear, but the execution is challenging.

Our OpenView team understands that the key to ongoing success of an e-business is end-user satisfaction. Whether that end user is a potential customer, a business partner, a vendor or an existing customer, you must ensure that they come back. With competition just a mouse-click away, loyalty is measured in seconds and perception is the only reality. Both business and IT organizations must realize that this isn't business as usual.

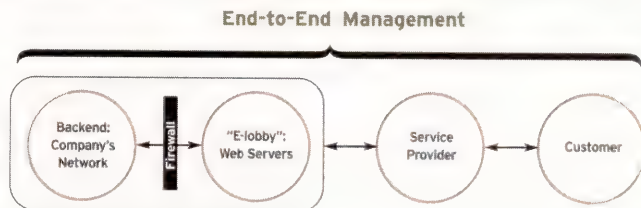
HP OpenView solutions provide the eyes and ears to assess your customers' experience. With a leadership position in end-to-end IT management and new technology developed specifically for managing e-services, OpenView solutions provide the necessary IT management capabilities in the three areas essential to success in an e-world:



In this make or break environment, it is important to recognize that an e-business or service is not just another application to manage. Traditional IT management that focuses solely on network components and web server status won't tell you what the availability or wait time is from your customers' viewpoint. IT management in this new world of "e" must focus on the customer experience and the service as a whole.

Providing Bulletproof Service

Providing bulletproof service means that your entire e-service must be well-managed. You've got to be able to "see" from end to end; there simply can't be any portion left in the dark. And you've got to be able to manage what you see. From the backend intranet to the customers' actual interaction with your electronic business, you must be able to provide 100% availability, per-



formance and security.

OpenView solutions deliver true end-to-end management from the perspective of the service, not simply the components. No other vendor offers greater breadth and depth of management functionality across the IT environment than OpenView. And in this new e-world this not only means your internal IT environment but also the services of your external service providers.

Whether you need to ensure network bandwidth for critical applications, protect vital company data while maintaining business continuity, provide proactive management of applications and their underlying infrastructure, or any of the other critical management tasks that today's complex IT environment requires, OpenView solutions give you the tools to guarantee the bulletproof service your end users count on.

Ensuring Optimal Encounters

Doing it right in the e-world means satisfying the end user. And for those who get it right, the rewards can be tremendous. IDC's Internet Commerce Model estimates that high-end commerce sites were doing annual business of around \$12 billion at the end of 1997 and will total over \$426 billion by 2002. In this e-business world, providing a superior end-user experience means more sales. It's that simple.

OpenView has been a pioneer in the area of IT Service Management for the past three years, supplying our customers with solutions that tie IT metrics directly to business objectives. Building on this strong foundation, OpenView now offers management tools that allow you to look at your e-service from your customer's point of view, so you know exactly what their experience is. This information is vitally important in providing the level of service that keeps customers coming back.

For example, HP OpenView Observer clocks and reports the actual round-trip transaction times experienced by your customers. These and other IT metrics are correlated with identified services and business objectives so both business and IT managers can assess the impact of events on the e-business. With this critical information in hand, the right decisions can be made for the business as a whole. In addition, OpenView solutions allocate IT resources for the services you specify, so you can be sure the e-service gets the IT resources needed to maintain customer satisfaction.

Delivering Rapid Control

Every aspect of e-business hinges on speed. There is an entire new time standard in place – Internet time. If you're not keeping up, the bottom line will suffer. For today's businesses, the same urgency that the Y2K problem has attracted should be directed to the "E2K" challenge of delivering e-services in Internet time.

Keeping pace begins with rapid deployment. You can't wait for the management solution when the e-business is ready to launch. OpenView's building block approach means incremental deployment to solve today's management challenge today. Unlike framework approaches, our out-of-the-box functionality can be operational in days, not months or years, so you see return on investment right away.

Rapid deployment is only half the equation though. Keeping pace also means simplifying daily operations to free up staff resources to handle events before they become problems. Keeping an e-business running smoothly requires quick response to an immediate need or an unexpected development. OpenView's advanced automation, escalation and notification capabilities put the right people on the right problem for faster resolution. With fewer problems, end users are happy and the bottom line prospers.

We're Ready When You Are

Capitalizing on e-business both today and in the future can be the difference between ongoing success or business failure. There are enormous revenues at stake and a "business as usual" strategy won't succeed in Internet time. A successful e-business requires quick responses and precise execution.

Fortunately, you don't have to do it alone. HP OpenView solutions are geared for the smallest enterprise or the largest Internet Service Provider and offer industry-leading IT management tools and expertise to help you transform the opportunities of the Internet age into business success. For ten years in 120,000 installations worldwide, HP OpenView solutions have been helping businesses succeed. We're ready to help you.



MAUREEN MELLON MANAGES THE HP OPENVIEW E-SERVICES MANAGEMENT BUSINESS.



HP OPENVIEW

Works | Right | Now

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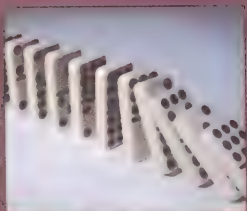
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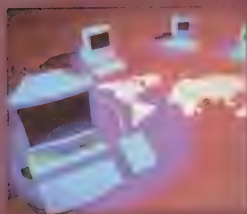
TECHNOLOGY MANAGEMENT GROUP



DIS' Technology Management Group was created to help combat the modern-day challenges encountered by professionals in today's IT environment. Our mission is to continue to provide clients with clearly defined solutions that offer substantial ROI. TMG is comprised of technical specialists who have completed hundreds of successful client engagements across the country. As solutions providers, we are organized into seven practices:



Mission Critical Computing



Desktop Management

Operations Automation



Internet Service Management

Deployment Services

Network Security Services

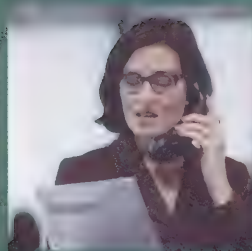
Technology Management Consulting

DIS has been a business leader in technology management and technical services since its inception. In the beginning, DIS supported broker and trader platforms on Wall Street and satisfied their stringent requirements for fast, efficient service. We achieved our reputation by building and supporting their technical infrastructure. Our integrity and reliability differentiated us from other IT providers.

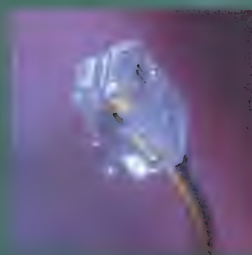
As the millennium approaches, DIS remains committed to its founding principle. We are still passionate about providing value to our customers by satisfying both their business and technology needs.

**Guy Fessenden,
Chairman & CEO**

TELECOMMUNICATION SERVICES GROUP



DIS's Telecommunication Services Group specializes in assisting companies in the design and integration of global communication environments. All TSG services are created to meet our customers' unique business objectives to ensure customer satisfaction. TSG sales executives, technical specialists and engineers provide:



Project/Program Management

Site & Environmental Surveys

Equipment installation & Upgrades



Network Design, Analysis & Administration

Asset Inventory & Analysis

Data Center Consolidation



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IT Enterprise Solutions

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STRATEGIC PARTNERSHIPS

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Qwest Communications

Veritas/Seagate

Cisco Systems

Lotus

FileNet

Formus Communications

Storage Tek

Nortel Networks

Gates/Arrow

Distributing



E-BUSINESS



Our sister company, Syndesa, Inc., is an industry leading software company that provides business-to-business solutions for both the Microsoft and UNIX environments via its robust e-business software CoreCommerce™.

To ensure that CoreCommerce solutions maintain optimal reliability and performance, Syndesa offers end-to-end services including consulting, design, integration, mission critical support and work flow assessment through its Professional Services Organization and its network of industry leading strategic partners.

Making Perfect Sense of Technology

Achieving results with IT in an E-business world

Our goal is to be a flexible and scalable set of IT resources to help our customers thrive in the E-Business World.

Perfect Solutions is committed to helping customers make the transition to an E-business model.

As an architect and implementer of solutions for E-business, Perfect Solutions believes that Hewlett Packard, more than any other platform provider, has the vision, breadth, technology leadership and financial resources, to be the platform of choice for the majority of customers. This is why we are an HP Exclusive platform provider.

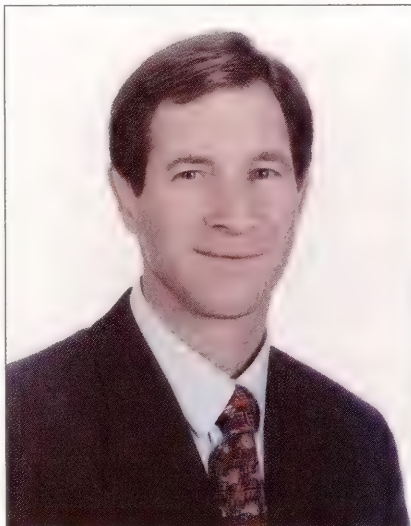
Perfect Solutions has been consistently recognized by Hewlett Packard as Master Level Best-in-Class, for our commitment and performance on behalf of HP and its customers. We surround industry leading HP 9000 Unix, Storage, HP3000 MPE and Intel platforms with the best in networking and internet and application tools from Cisco, Microsoft and Oracle to develop and deliver solutions which are sound and scalable.

Friendly and relationship oriented, we're committed to being the best partner – the easiest to do business with, the best at listening and assessing customer needs.

Talented technical staff. Perfect Solutions starts with the best and the brightest. But this alone is not enough. We look for attitude, customer focus, and a real dedication to excellence. Our staff receives ongoing training in new technologies, updating of certifications and customer relationship skills.

In our areas of focus, we deliver excellence in both solution design, implementation and support by following proven consulting and problem solving methodologies.

- Hewlett Packard Servers and Storage – HP9000, HP3000, Netservers, XP256



PAUL SITA, PH. D., PRESIDENT, PERFECT SOLUTIONS

- Expert in sizing, configuration and migration planning for all third party packages, including SAP, Peoplesoft, Baan
- Server consolidation design and implementation services
- Enterprise storage area network design and implementation

- Performance analysis and tuning
- High availability consulting, design and implementation, MC/Serviceguard certified

- Enterprise backup design and implementation – Omniback II

• Infrastructure services

- LAN/WAN assessment/design
- E-mail and messaging solutions, MS/Exchange, SQL server
- Cisco Partner for Enterprise Solutions
- Network and content security
- VPN and remote access solutions

• E-business Applications

- Electronic catalogs
- Intranet and Internet application development
- Legacy application extensions to the web HP3000/HP9000
- EDI processes via the web

With customers demanding complex solutions such as these, it's no longer possible to neatly separate hardware from infrastructure and applications. Achieving results with IT requires knowledge and experience in all these areas.

For our customers, our goal is to be a flexible and scalable set of IT resources to help them thrive in the E-business world. This mission drives everything that we do at Perfect Solutions. It's what we do. And we do it Perfectly.

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Fax: 516-719-1700
URL: www.perfectsol.com

IN A PERFECT WORLD... TECHNOLOGY KEEPS PACE WITH YOUR BUSINESS

ARCHITECTS FOR eBUSINESS...

■ HP EXCLUSIVE PLATFORM SPECIALIST—

HP9000, HP3000, NT, XP256

■ MISSION CRITICAL INFRASTRUCTURE

■ eCOMMERCE & LEGACY APPLICATIONS



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OMICRON – Taking you from E-Vision to Value

The Internet Revolution continues to change how we approach business.

Next generation competitive strategies will be born as we complete the marriage of business strategy and technology. That union is E-Commerce.

Most businesses now realize that they have outgrown their initial Web site, like a child outgrows a pair of shoes. Executives are asking themselves how to go beyond the homepage. They see that E-Business will drive new corporate strategies in this post-millennium business environment. Leading the selection of fashion or future technology requires an acute awareness of new complexities, changes in style, investment considerations and the need to insure our next purchase satisfies our specific tastes and objectives.

As we consider new shoes, their style and fit, we glance into the mirror insuring that it communicates image along with functionality. That same confirming review in business is the role of E-Visioning, a process of enhancing, re-setting or finding anew, future E-Marketing directions. According to Randy Pritzker, President of Omicron, "E-Business is more about strategy than technology." He continues, "through Omicron's E-Visioning process, you are presented with the opportunity to correctly fit emerging business/market conditions with the new generation of E-Business technologies."

E-Business systems are to a Web site, what Ferragamo's are to sneakers. E-Business systems are complex, both in business process and technical implications. There is nothing casual about the definition and technical implementation of E-Business, unlike the first generation of Web sites.

Omicron's E-Vision Process

Omicron has developed a unique methodology that guides the translation of business and marketing strategy, through the construction of E-Commerce architecture and applications. Omicron's E-Vision approach incorporates the technology position of competitors, industry-specific technology trends and their effect on customers, and the opportunities for joint branding, co-marketing and investment strategies residing within the selection of the appropriate enabling technology.

"The race for E-Business demands creative version planning, the blueprint which administers the relationship of broad functionality to delivery urgency. Omicron's E-Vision process uses software product planning methods to created "time-to-market" release strategies



DOES YOUR BUSINESS NEED A NEW PAIR OF SHOES?

The process culminates in Omicron's high-performance E-Apps Production Development Center. There Omicron develops the complete application, including the integration of leading third party products, as new sites and E-Business applications are programmed, tested and released to efficient and scalable hosting infrastructures.

As with a purchase of new shoes, comfort comes when you have aligned your business direction with an E-Business strategy, architecture and system design. Any business that does not find itself well fitted with a multi-dimensional E-Business strategy can expect in time, to find itself limping along. An effective E-Business vision and your new pair of shoes should provide comfort and stability as you move towards the next generation in your company's growth.

OMICRON

Omicron is an E-Business Applications Developer and E-Infrastructure Company assisting customers in the design and delivery of next generation competitive business strategies and their corresponding E-Business systems. With the advanced design perspective of a Microsoft Solution Provider Partner and HP Best in Class Master Level Reseller, Omicron is leading this convergence of information technology and business strategy using intra and extranet technologies.

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Phone: 215 854 3400
Fax: 215 854 0079
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From E-Vision to Real Value

Building Applications.

Building Infrastructure.

Building Solutions.

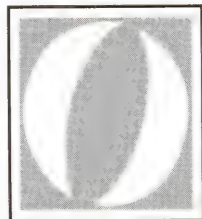
Omicron's E-Infrastructure Services . . .

The union of creative design/implementation
with scalable HP Technology . . . **architectures**
for E-Business and beyond!

Omicron's E-Vision™ process and E-Apps Development Center™ . . .

Streamlining the creation of strategic
systems to support the full range of E-
Business applications and .com ventures.

As an **HP Best in Class MasterLevel Reseller**
we can deliver HP9000, NetServers and
OpenView products you'll need to keep E-
Business up and running.



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*we'll help you
.com and get IT!*



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(215) 854 - 3400

CNT: Building Networks for Continuous E-Business

CNT is building networks for business continuance, using a wide range of HP and other servers, storage systems, channels, LANs and WANs.

HP's vision of the computing future is tied to the evolution of the Internet and the delivery of e-business. When you can be open for business 24x7, and competitors are a mouse click away from your customers, your e-business services need to remain available. That means a pervasive, reliable, and manageable network infrastructure has to be in place.

As a result, the Internet and e-business are driving the interest in business continuance—the set of networked technologies and processes that ensure the flow of information whenever and wherever it is needed to keep a business operating. That's where CNT comes in, helping HP professionals design, deploy, and manage mission-critical networks that stay up, and go far.

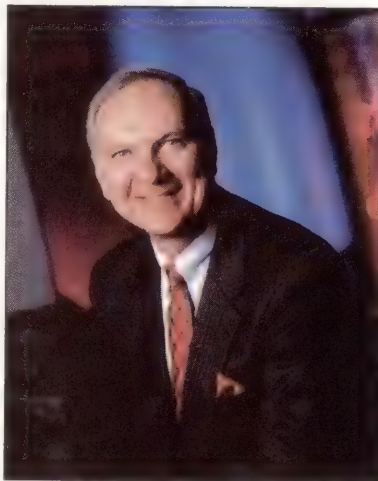
"Business continuance is the latest evolution of CNT's crucial role at the nexus of the enterprise, connecting the open and the proprietary, the old and the new, the local and the remote, without sacrificing performance, security, or integrity."

Building Networks for Business Continuance

To be up to the job of business continuance, networks have to provide all the needed data, all the time. That means information and applications have to be available during planned and unplanned outages. Therefore, the network needs to move data transparently in real time or close to real time between different locations and different environments, including, say, a mainframe environment and a HP-UX data warehousing environment. Different servers, operating systems, and stor-

age devices need to play together.

Second, the network has to be extremely fault-tolerant and very response-time oriented. That means the network must deliver the required application response times for the users and also respond quickly in detecting and correcting any failure in its infrastructure. The system needs to adjust quickly and transparently, automatically switching to a secondary link in the event the primary link fails.



THOMAS G. HUDSON, PRESIDENT, CEO AND CHAIRMAN OF THE BOARD FOR COMPUTER NETWORK TECHNOLOGY.

The Storage Area Network (SAN) Assessment

For many customers, CNT's involvement in business continuance starts with a Storage Area Network Assessment, a service to evaluate and recommend a storage network infrastructure. This assessment comprises three elements. The SAN Audit involves gathering information to understand the customer's storage and business continuance environment. When completed, the comprehensive audit covers the IT, enterprise, and business environments, and profiles the customer's storage strategies, equipment, and challenges.

The audit serves as input to the SAN Analysis, which generates a set of product recommendations. In turn, the audit and the analysis feed into the Business Case, which summarizes the cost of the solution and its business value to the customer. CNT continues to surround the solution with implementation planning, performance tuning, and ongoing support, to ensure that the business continuance network fulfills its new and demanding role.

Feel Secure and Worry Free

While you're sleeping soundly, CNT minds your network for secure, worry-free business continuance.

Integrate your storage systems with CNT's proven wide-area connectivity to backup and restore your data to any location—at any distance.

The result is the security and unsurpassed protection of remote data backup and the ability to electronically restore your system data within minutes, instead of hours or days.

CNT's Business Continuance Solutions—with their proven reliability, and connectivity—keep your network running smoothly and comfortably night after night.

Rest easy with CNT.

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Call

or visit our web site for a white paper on CNT's Business Continuance solutions.

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CNT

Computer Network Technology

The Brave New World of "E"

Management and Support of Your E-Infrastructure

It's a known fact. E-business, e-commerce and e-services touch or will soon touch every mission critical facet of your organization: from financial and enterprise applications, to customer relationship and supply chain management, to on-line transaction and order processing.

The Enterprise is turning inside out...it used to be that IT supported the business. In today's "E" world, IT is the business.

This evolution is changing the face of business. Instead of face-to-face meetings or phone conversations with your customers, businesses must tap into the brave new world of "e" commerce. Customers now have access to a once hidden part of your organization—your **data center**. In traditional businesses, you typically know who your customers are. However, in the digital world, any of 150 million Internet users can visit you—generally anonymously.

How can a company ensure success in this ever-evolving marketplace? Logical—a global technology company and services company with over 3,000 people worldwide—has found that the way to succeed is to provide our customers with the solutions they need to stay ahead of the game.

Specifically, our focus is to continue to meet the increasing Management needs of our customers who are focused on building market leadership through innovative "Enterprise Management Solutions."

Complete networking solutions. E-business consulting services. Web-integration capabilities. Logical is a strong provider with the proven ability to able to deliver all the components needed for e-business systems. Which is good, when you consider this statement from The Economist: "Within a few years, the Internet will turn business upside down. Be prepared—or die."

While this piece of advice may be a little foreboding, Logical has taken it to heart. And, as a result, we've been successful. Much of our success in this rapidly changing segment can be attributed to two things: our proven industry talent and our continual focus on technology. In fact, Logical is proud to be home to the largest corps of HP OpenView service experts outside of Hewlett-Packard itself. Moreover, the Logical staff is highly trained across the entire HP OpenView solutions suite.

As you know, businesses face a fundamental challenge of delivering the best possible customer experience in the new world of e-commerce, e-business and e-services. We are proud to be at the forefront of helping make the vision of E-services a reality. The breadth of Logical Enterprise Management offerings and the depth of our OpenView expertise ensures that we will continue to deliver a superior solution needed to succeed in the evolving digital marketplace.

It's Only Logical.

Logical is the global network integration and e-business services division of Datatec Limited, a global technology and services company with South African origins. Headquartered in the UK, Logical provides complete end-to-end solutions, including

LAN/WAN infrastructures to desktops, servers and applications development, managed and outsourced network services and Internet-based e-business solutions.

Through a combination of strategic acquisition and organic growth, Logical is expanding its North American operations to over 300 employees in 32 offices nationwide. Logical is now one of a few global providers with the ability to deliver all the components

needed for e-business solutions. Logical has established strategic partnerships with Cisco Systems, Hewlett-Packard, Baan, Oracle, Microsoft, Nortel Networks, IBM, 3Com and others.



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www.us.logical.com

*A competitive world offers two possibilities.
You can lose. Or, if you want to win, you can change.*
—L.C. Throwing



Change is good. It's only Logical.

In a world of constant change, sometimes it seems that change itself is the only constant. As one of the world's largest providers of network-based IT solutions, Logical embraces change. We have to. That's how we continue to grow our resources and expand our reach. That's how we're able to understand our customers' needs, customize solutions to fit these needs, and implement them quickly to maximize productivity and generate revenue. After all, it's always been our goal to strive for the best and change for the better.

For more information, please contact Debbie Scartozzi at (248) 335-8700.



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 DATATEC company



HP Helps America's Second Harvest Feed the Hungry

A Vision of E-Services to Come?

"I've been talking about reinventing the Net to make it work for you. In some ways, that sounds selfish and I don't mean it to. In fact, e-services affords us the opportunity to create communities, for example communities of people who are in need of a service for people who can deliver that service. One example of an e-service at work that makes me particularly proud, because it's an example of the Net being used, not to create IPOs, not to create market cap. It's an example of the Net being used to solve fundamental problems -- hunger."

-- Carly Fiorina, HP's CEO and president at Comdex, November 15, 1999

With those remarks Carly Fiorina introduced ResourceLink, an Internet-based e-service aimed at fighting hunger. ResourceLink pairs food suppliers with surplus food or products with certified charitable organizations that can use the goods for their relief or disaster-response programs. This Internet e-service is freely accessible to food manufacturers and suppliers and transportation companies as well as to America's Second Harvest food banks and other charities. America's Second Harvest is the largest hunger relief organization in the U.S. with a network of 189 regional food banks that distribute over a billion pounds of surplus and donated food to 21 million Americans each year.

Although America's Second Harvest fed 21 million hungry Americans last year, it was not enough, claims the food bank's President and CEO, Deborah Leff. "We simply are not meeting the increasing need. According to government statistics, 35 million Americans are hungry or at risk of not knowing where their next meal is coming from."

ResourceLink is an HP designed and operated e-service portal that connects manufacturers and others willing to donate food. Working with America's Second Harvest, ResourceLink helps

"I've been talking about reinventing the Net to make it work for you."

Carly Fiorina, HP CEO and president

provide an efficient way to identify and distribute surplus food to 189 food banks around the country. Those food banks support nearly 50,000 shelters, agencies and kitchens that manage 94,000 food programs. In 1998, Second Harvest distributed products to over 50,000 agencies, helping more than 26 million Americans.

"Technology is essential to our work to feed hungry Americans. Innovations like ResourceLink will dramatically help us get more food, more efficiently to where it's needed most," says Leff.

While initially focused on bulk surplus food distribution, ResourceLink will soon be expanded to provide processed food, clothing and building materials to certified relief organizations. Hundreds of leading food manufacturers, transportation companies, retailers and media groups have already pledged to support ResourceLink including: Cyber Surplus, Grocery Manufacturers of America, International Food Service Manufacturers Association, Lebahar-Friedman, Nation's Restaurant News, National Restaurant Association, National Transportation Exchange, the U.S. Department of Transportation and the U.S. Department of Agriculture.

The ResourceLink portal uses Match-and-Alert technology provided by Cyber Surplus to match donor resources to specific needs of individual charities. Then, ResourceLink accesses another e-service, the National Transportation Exchange (NTE), to locate transportation companies that can provide no- or low-cost shipping - often the most difficult aspect of feeding the poor. This process, which used to take days or weeks, is completely automated over the Internet and requires only hours or minutes with HP's e-services model.

Remarkably, it took HP's Customer Service and Support Group less than 90 days to obtain support from other contributors, design the site, make the links, write the code and go live. This was accomplished at the relatively low cost of \$2 million for everything, including marketing. The first day ResourceLink went into operation, over 1 million pounds of food were donated by Ateeco, CongAgra., General Mills, Kellogg's, Kraft Foods, Mead Johnson Nutritionals, Nabisco, Pillsbury and Tyson Foods.

It is a win-win: The hungry are fed. Corporations get to reduce the estimated 100 billion pounds of surplus food wasted each year. And transportation companies can fill the trucks and cargo ships that are currently running 30 percent empty.

ResourceLink has proved that charity and cooperation can be a very good business. According to Bill Hornung, HP Manager of ResourceLink, four of the portal's partners are so convinced of its value that they plan to launch significant commercial ventures in

the coming months to optimize their own business and supply chains. Says Hornung, "HP helped create ResourceLink to greatly simplify the donation process. It was a matter of connecting the dots - the infrastructures, alliances and services that already exist. The same concept can add value to virtually

every kind of business process. Our partners realize that you don't necessarily have to revolutionize your operations or spend a fortune to do some pretty dynamic things on the Web."

ResourceLink acts as a virtual warehouse. Food companies go online to post inventory available for donation. The need for a flurry of phone call, faxes and back-and-forth paperwork is eliminated. The system securely stores all donor information, including details on previous donations.

Once Second Harvest accepts the donation, ResourceLink automatically links to an alliance of shipping companies that often can provide no-cost or low-cost transportation. At the same time, Second Harvest member food banks can instantly see what's available and order the products they need using a few easy steps.

By linking givers and receivers quickly and efficiently, ResourceLink helps assure that donations reach as many people as possible. Also, more efficient mechanisms allow Second Harvest to accept a larger volume of food donations that might otherwise go to waste. With ResourceLink network in place, Second Harvest can quickly accept and remove surplus products to free up donors' valuable warehouse space.

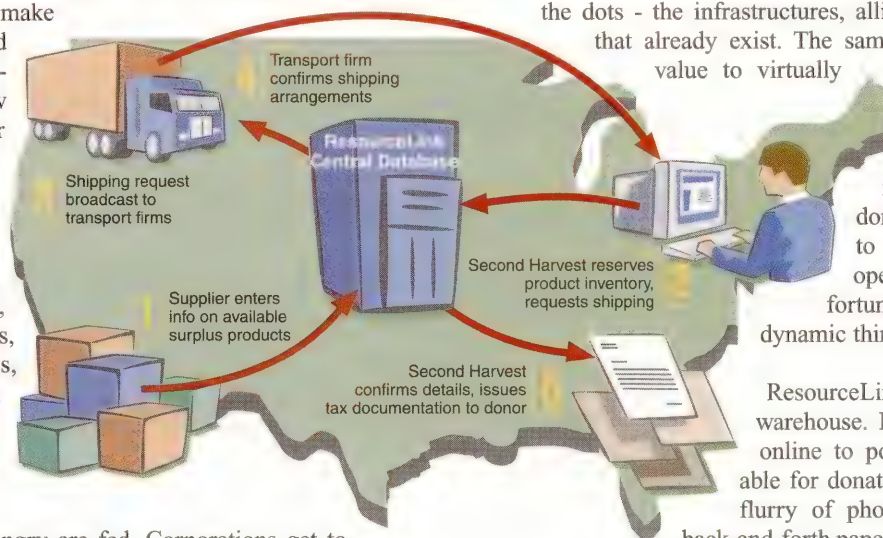
- America's Second Harvest
www.secondharvest.org
- Cyber Surplus
www.surplusfoods.com
- Grocery Manufacturers of America
www.gmabrands.com
- Hewlett-Packard Company
www.hp.com
- International Food Service Manufacturers Association
www.ifmaworld.com

www.resourceink.org: Hungry For A Solution
* About 26 million people go hungry on a regular basis in the U.S. each year. Of this number, 38 percent are children under 18 and 16 percent are over 65.

* Worldwide, a billion people are too poor to afford an adequate diet. Last year alone, two million people starved to death in North Korea and Sudan.

In the U.S. alone, nearly 100 billion pounds of surplus food goes unused each year.

The root cause of hunger is often a problem of distribution -- how to get the bountiful supply to the right places at the right time. This is a complicated matter because it's been difficult to match where surpluses are and then quickly move them to areas of need.




ResourceLink

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E-mail bill_hornung@hp.com

GOT THE TIME?

Microsecond Timing Accuracy for Your Network Applications

How to synchronize your networks to UTC anywhere in the world—easily, inexpensively, with microsecond accuracy.

Networks need timing. Precise clock synchronization is critical for reconciling and recovering E-commerce and enterprise databases that may span multiple campuses or continents. Network security and encryption key exchanges depend on time stamps for authentication. Precise event time-tagging has applications in performance analysis, multimedia applications such as audio/video conferencing, and a host of scientific applications.

Many of these applications cannot spare resources to obtain timing and synchronization signals from the network, and hardware (bus) synchronization interfaces are cumbersome and expensive.

The Palisade NTP Synchronization Kit

The Palisade™ NTP Synchronization Kit (the Sync Kit) enables an existing computer system to precisely calibrate its system clock to Universal Coordinated Time (UTC), without degradation due to system load. Database transactions and other system events can be tagged with microsecond precision, allowing performance servers to establish transaction ordering based on time stamps to UTC, at rates of over 100,000 transactions per second.

The Sync Kit is easily integrated into embedded systems and can be used for timing in mobile applications. Your network clock is synchronized with stratum-1 accuracy to the UTC standard available worldwide through the Global Positioning System (GPS).

The Sync Kit includes the Palisade GPS smart antenna and a Synchronization Interface Module (SIM). The smart antenna is a compact combination GPS antenna and receiver, which generates a timing pulse (PPS) and event time stamps that are synchronized to UTC within ± 100 nanoseconds. The SIM combines all power and data connections into one small box and connects to a standard RS-232 serial port on your server.

Network Time Protocol (NTP)

The Palisade NTP Synchronization Kit can be used as a reference clock for NTP, the standard for data network time distribution. NTP is supported by all major operating systems, including

HP-UX, Solaris, Linux, and Windows NT.

TimeTrigger Technology

Trimble's unique TimeTrigger™ technology allows the host computer to precisely determine its offset from UTC without degradation of timing accuracy due to system load.

In a pulse-per-second (PPS) environment, multiple tasks, including timing, compete for the CPU's attention. Either the CPU must make timing a very high priority task—as in a dedicated time server—or timing is subject to delays while waiting for the next available CPU cycles. Similarly, since communication through the serial port is a low-priority task, it is subject to additional delays.

The TimeTrigger feature avoids variable delays or timing degradation by permitting the CPU to initiate the timing request. The server sends a pulse to the Sync Kit and receives back a time stamp, indicating the exact time the pulse was generated. The CPU processes the time stamp at normal system priority. Heavy network loads or high CPU utilization do not affect the accuracy of the time stamp.

The Universal Timing Solution

If your network spans multiple campuses or continents, just add a Palisade NTP Synchronization Kit at each host server to sync it to the global UTC standard.

It's easy, inexpensive, robust, and reliable—the universal timing solution.

Trimble is the first name in GPS, with more experience, products, and patents than any other company. We add value to GPS to make it more useful and accessible in your world—anywhere in your world.



THE PALISADE NTP SYNCHRONIZATION KIT

Contact Information:

Trimble Navigation Limited
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The kit plugs in to a network server and provides the functionality and accuracy of a dedicated time server for a fraction of the price. Using NTP and GPS, the network time is accurate to the microsecond anywhere in the world.

Trimble's TimeTrigger™ technology ensures that the Palisade NTP won't interfere with the system. It's ideal for time-dependent network applications, such as synchronizing switches and routers, time-stamping financial transactions, e-commerce and distributed systems.

The Palisade NTP Synchronization Kit is from Trimble—the first name in GPS.

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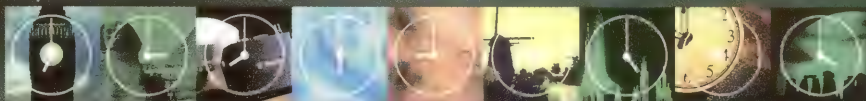


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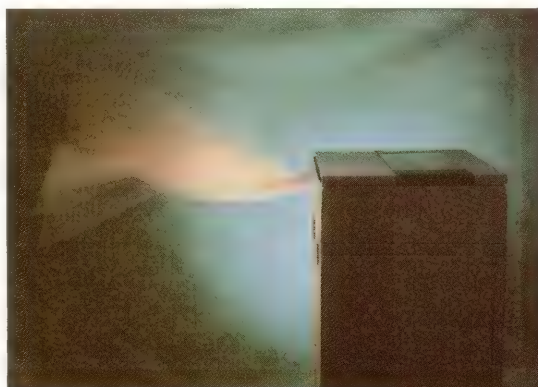
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ROC Software is a company composed of people with one common goal at heart, to provide our customers the highest level of software product support and development. With a staff of original developers and experienced support engineers, ROC is moving into the new millennium offering customers the highest level of software product support and development. Superior service is our company's fundamental principal.

Our strength lies in our developers who have over 200 years of collective MPE experience and in our support engineers who average more than 15 years MPE experience. ROC's current MPE products are Formation electronics forms design and print utility, SpoolMate output and print device manager, Maestro for MPE batch job scheduler, RoadRunner for MPE backup and recovery utility, Tapes Plus tape library management and reporting utility, and DCM Pak data center management utility. By enhancing our existing products, creating new products, and providing an outstanding level of customer service, we will improve our customer's ability to use their current business systems in their overall strategy.

Being uniquely qualified to meet the needs of our customers in the year 2000, we are driving forward by creating additional products and solutions for systems management inter-operability.



**ROC FEATURES SOFTWARE FOR OUTPUT
MANAGEMENT, BACKUP, AND BATCH JOB
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ty. IT managers can rely on ROC's expertise to build and improve upon our "ROC Solid" products. "Our inter-operability commitment isn't porting software to every platform, but rather integrating with strategic solutions that customers already have," says Danny Compton, ROC's Director of Development, "Our RoadRunner for MPE client module for the Tivoli Storage Manager™ enterprise server is a great example of this integration in our backup solution."

As we go forward into the new millennium, we are committed to improving system and product inter-operability for customers in mixed platform environments. As environments continue to change, it is our role to continue to create new business solutions that make customers more successful. We believe that moving forward does not mean leaving where we are.



**ROC'S SOFTWARE PROFESSIONALS BELIEVE IN ROC'S
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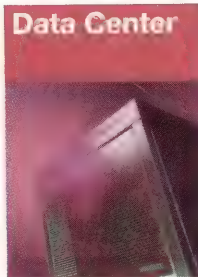
With RoadRunner and TSM, you can migrate, retain, expire, or duplicate backup and archival information to a TSM server. The TSM server is supported on a wide variety of platforms, including HP-UX™ and Windows NT™, and with the RoadRunner MPE/iX client module, brings new functionality to the HP 3000 including point in time restore, "incremental forever" backups, vital records retention, and advanced catalog and device management capabilities that completely automate backup and recovery operations when used with Automated Tape Library (ATL) robotic devices... All this without compromising the speed, functionality, and ultra-reliable recovery you've come to expect from RoadRunner for MPE.



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HP Delivers Affordable Instant On-demand Capacity

Like "mom" and "apple pie," capacity planning for your servers is a great concept and one that few people in an organization will argue against. It makes good sense to plan the acquisition of server hardware to meet anticipated growth demands.

However, the pace of business – e-commerce and e-business in particular -- can move faster than even the most aggressive or labor intensive capacity planning efforts. So, when your firm posts a sensational offer on its Web site and demand spikes through the roof, it is a modern IT hero who can react to the unanticipated demand placed on a system and stay online as well as keeping the system responsive.

The Web has created an expectation, on the part of users, of speed and immediate response. Systems, even those that are non-Internet based, are viewed critically if they fail to meet comparable response times. When applications serve a large population or become heavily used during a business day, they can tax CPU capacity.

Today's business volatility cries out for a solution to capacity spikes and rapid, unplanned increases in user demand. Ideally, servers should ship to customers already populated with expansion CPUs. However, until now, that idea has been impractical based on the initial capital outlay a company would have to make to retain "spare" CPUs.

Both Sun and IBM have or are in the process of announcing offerings in which CPUs come bundled in a server package. HP's iCOD (for instant Capacity On Demand) November announcement differs from the Sun

and IBM packages in terms of its breadth, pricing and flexibility. Breadth is of immediate interest, since the offering extends across HP 9000 L, N and V-Class servers. This makes iCOD particularly attractive to Internet-based businesses who tend to rely on these cost-efficient product lines.

Specifics on the program include the following:

- There is no separate charge for iCOD CPUs that are shipped but not enabled
- There is a small monthly service charge for iCOD participation. It varies based on system size and the number of iCOD CPUs configured
- CPUs are activated when needed based on a user issued software command.
- After activation, payment is simple and is based on the current HP price for an activated CPU. No special premium is added just because it is an iCOD CPU.

Instant capacity means that a server farm can almost always bypass downtime (which leads to impaired capacity and slower response time) for upgrades, scheduled maintenance or repairs. This is because CPUs can be instantly brought online to replace those that need to be taken down for service or repair. In the event of a CPU failure in an iCOD system, the system automatically restarts with an additional iCOD CPU activated at no charge. This is seen as a major advantage in helping company IT departments and Internet providers meet service-level commitments.

"Our customers have told us that they want a flexible, scalable and highly available service on the Internet, that is why iCOD is a great fit," said Janice Chaffin, vice president and general manager of HP's Business Critical Computing Business Unit. "We've tailored this program so that it is affordable and within the reach of nearly every server customer and partner, from start-up companies, to service providers and enterprises."

HP's iCOD, in contrast to its competitors' offerings (See side bar), is not limited to the high-end market. The unique pricing structure makes immediate capacity

changes accessible to startups, small to medium size businesses, "dot com" enterprises, service providers and enterprise customers. HP has extended its investment protection, as well, to all current customers. This means that iCOD is available on existing installed systems and there is no charge for additional iCOD CPU's ordered as upgrades.

Orders for iCOD systems will begin in January 2000. For additional information on HP's iCOD offering, go to a special location on HP's web site, www.hp.com/go/icod.

Comparison of iCOD Solutions	HP	Competitors
Breadth of Program	Across the HP9000 server product line: entry-level L-Class, mid-range N-Class as well as high-end V-Class servers.	Offering is at the high-end
Pricing	Entry-level pricing starting at \$16,000 plus a small monthly service charge for L-Class iCOD. HP does not charge for additional iCOD CPUs until they are activated, and then bills the customer according to standard pricing.	Steep initial cash outlay and the charge for activating an additional CPU is up to twice the standard pricing.
Flexibility	Allows choice among CPUs in the initial iCOD systems	No flexibility, with minimum configurations required at high-end only
Customer Coverage	Includes enterprises, dot-coms and service providers. HP customers with PA8500-based servers also can upgrade to iCOD	Addresses a small number of traditional data center customers
High Availability	If a CPU failure occurs, the system automatically restarts with an additional iCOD CPU activated at no charge	Not available on UNIX

Omicron Consulting

Omicron Consulting (Philadelphia, Pa.) is an e-business application developer and e-infrastructure company which focuses on guiding the translation of business and marketing strategy with its E-Vision approach.

Omicron's E-Vision incorporates the technology position of competitors, industry-specific technology trends and their effect on clients, and the opportunities for joint branding, co-marketing and investment strategies residing within the selection of the appropriate enabling technology. In Omicron's E-Apps Production Development Center, Omicron develops a complete e-business application, including the integration of third party products, custom fitted to your company's needs.

Contact Omicron Consulting at (215) 854-3400, www.omicron.com.

Perfect Solutions

Perfect Solutions (Roslyn Heights, N.Y.) is committed to helping their customers thrive in e-business by providing a flexible and scalable set of IT resources. Perfect Solutions is an HP Exclusive platform provider and is expert in sizing, configuration and migration planning for all third party packages.

Among services and solutions offered are server consolidation design and implementation services; enterprise storage area network design and implementation; performance analysis and tuning; high availability consulting, design and implementation; infrastructure services; LAN/WAN assessment and design; e-mail and messaging solutions; e-business applications; and Intranet and Internet application development.

Contact Perfect Solutions at (516) 719-1600 or www.perfectsol.com.

Forsythe Solutions

By teaming with leading players across all segments of the market, Forsythe Solutions (Skokie, Ill.) is cre-

ating a new breed of customer driven, turnkey Web solutions designed to ensure your company's success in the new millennium.

Working with their alliance partners, Forsythe guides its customers through all phases of the e-business solution. Forsythe's rapid implementation technology, Quick-ResultsSM, provides users with an optimal e-solution in the shortest possible time frame, which allows for maximum ROI on users' technology investments. Forsythe is HP's largest Enterprise Reseller, and many of their e-services incorporate solutions from companies such as Ariba, BEASystems, BroadVision and Oracle.

Contact Forsythe Solutions at (800) 843-4488 or www.forsythesolutions.com.

Computer Network Technology

Computer Network Technology (CNT, Minneapolis, Minn.) is committed to building networks for business continuance. CNT uses a wide range of HP and other servers, storage systems, channels, LANs and WANs to make networks that move data transparently in real time or close to real time in different locations and different environments and that are extremely fault-tolerant and very response-time oriented.

Many CNT clients start with a Storage Area Network Assessment, which evaluates and recommends a storage network infrastructure. This assessment, consisting of a SAN audit, a comprehensive audit and a SAN Analysis, gives CNT the information needed to provide its clients with a set of product recommendations, a summary of the cost of the solution and its value to the client. As well as the ability for CNT to continue to surround the solution with implementation planning, performance tuning and ongoing support to ensure business continuance.

Contact CNT at (800) CNT-0900, (612) 797-6000 or www.cnt.com.

HP OpenView

The HP OpenView (Fort Collins, Colo.) team understands that the key to ongoing success of an e-business is end user satisfaction. Therefore, HP OpenView E-service management solutions provide the necessary IT management capabilities in three areas essential to success in an e-world: bullet-proof service, optimal encounters and rapid control.

OpenView solutions deliver end-to-end management from the perspective of the service which offers greater breadth and depth of management functionality across the IT environment. OpenView management tools allow you to look at your e-service from your customer's point of view, enabling you to monitor the quality of service provided. OpenView also provides out-of-the-box functionality, which can be operational in days; as well as advanced automation, escalation and notification capabilities for quicker problem resolution. HP OpenView solutions are designed for both small and large companies.

Contact HP OpenView at (970) 898-3800 or www.openview.hp.com.

HP iCOD

HP's iCOD (for instant Capacity On Demand) extends across HP 9000 L, N and V-Class servers. This makes iCOD particularly attractive to Internet-based businesses that tend to rely on these cost-efficient product lines.

Specifics on the program include no separate charge for iCOD CPUs that are shipped but not enabled, a monthly service charge, CPUs are activated when needed, payment is simple and is based on the current HP price for an activated CPU. And no special premium is added just because it is an iCOD CPU. CPUs can be instantly brought online to replace those that need to be taken down for service or repair.

Contact HP's iCOD unit at www.hp.com/go/icod.

Logical

Logical (Bloomfield Hills, Mich.) provides complete networking solutions, e-business consulting services, and Web-integration capabilities to its customers who are focused on building market leadership through Logical's "Enterprise Management Solutions."

Logical boasts proven industry talent and a continual focus on technology. It is home to the one of the largest corps of HP OpenView service experts and its staff is highly trained across the entire HP OpenView solutions suite. With strategic partnerships with Cisco Systems, HP, Baan, Oracle, Microsoft, Nortel

Networks, IBM and 3Com; Logical can provide all the components needed for e-business solutions.

Contact Logical at (248) 335-8700 or www.us.logical.com.

ROC Software

ROC Software's (Austin, Tex.) strength lies in the MPE experience of its developers and support engineers. ROC's MPE products are Formation electronics forms design and print utility, SpoolMate output and print device manager, Maestro for MPE batch job scheduler, RoadRunner for MPE backup and recovery utility, Tapes Plus tape library management and reporting utility and DCM Pak data center management utility.

In order to provide the highest level of software product support and development and to improve their clients' ability to use their current business systems in their overall strategy, ROC is constantly enhancing existing products, creating new products and providing quality customer service.

Contact ROC Software at (512) 249-9294 or www.rocsoftware.com.

HP's ResourceLink

HP's ResourceLink, an Internet-based e-service aimed at fighting hunger and is freely accessible to food manufacturers and suppliers.

ResourceLink is an HP designed and operated e-service portal that connects manufacturers and others willing to donate food. Working with America's Second Harvest, ResourceLink helps provide an efficient way to identify and distribute surplus food to 188 food banks around the country. Those food banks support nearly 50,000 shelters, agencies and kitchens that manage 94,000 food programs. The ResourceLink portal uses Match-and-Alert technology provided by Cyber Surplus to match donor resources to specific need of individual charities.

For more on HP's and other food programs visit www.hp.com; www.secondharvest.org; www.surplusfoods.com.

Bradmark

Bradmark provides high quality database utility and client/server software and support. It's flagship product, DBGENERAL, offers a comprehensive family of database management tools that provides a single source for managing all aspects of departmental and enterprise-wide databases.

DBGENERAL's HP 3000/IMAGE version operates as a complete server-based solution, while DBGENERAL's RDBMS versions operate in an enterprise manner utilizing server agent technology. A fundamental hallmark of Bradmark's strategy is to utilize mission-critical applications used by existing legacy systems. This offers a

bridge between existing applications, and newly developed client/server applications, while it is tested for its mission-critical capabilities.

Contact Bradmark at (800) 621-2808, www.bradmark.com.

DIS International

DIS International, Ltd., located 30 miles north of the Golden Gate in Marin County, was created in 1981 by Mark Klein and is a full service technology firm that provides consulting, sales and support services specializing in HP computer systems.

DIS has provided consulting services to various companies such as HP, ORBiT Software, SBT Accounting Systems, MB Foster Associates, The Oakland A's Baseball Club, Zellerbach Paper Company and others.

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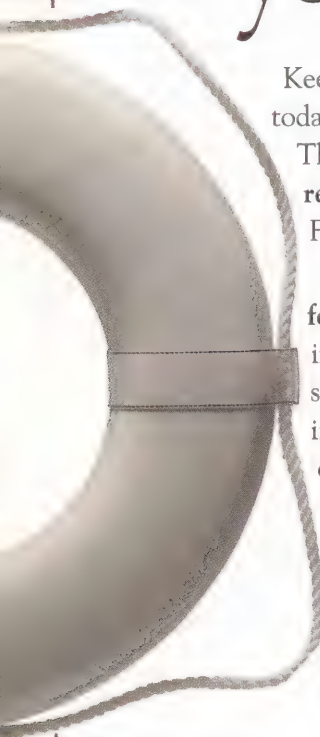
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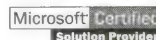
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Let The SAN Shine In

SANs That RAID-iate Benefits

LOCAL AREA NETWORKS (LANs) are typically made up of short-distance user groupings with modular efficiency. A Storage Area Network (SAN) can allow these groupings to access a common sphere of storage that serves all users as specifically and as immediately as needed. For example, you can extend the benefits of RAID technology with a SAN.

Suzanne S. Eaton

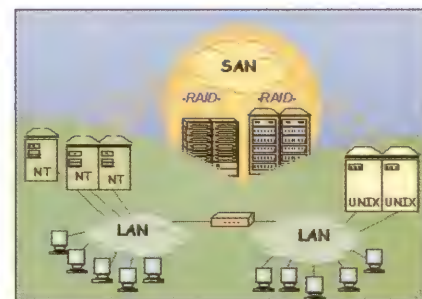
7:45 AM Eight hundred and seventy three employees fill coffee mugs, boot up PCs and begin accessing e-mail. Three Windows NT servers and two UNIX servers dish up approximately 42 new messages to each address. Staff members begin responding and attaching documents to each reply.

8:08 AM The sales department begins processing online orders, making electronic funds transfers and transmitting work orders for fulfillment. The marketing staff begins searching the Internet for competitive information, charting trends and creating competitive analyses. Press releases and corporate communications documents are distributed online to employees, press, analysts and investors worldwide. Graphic designers begin transferring files to and from an ftp site, Web masters begin updating e-files, outside sales people reach into the LAN for current presentations, accountants begin running reports and payroll queues up a check run.

8:45 AM An e-mail blast is sent to 4,700 potential customers. Documents are printing to more than 30 different printers. (Note to the IT Manager: 16% of your employees are playing graphic intensive games or visiting other sites.) Various files are transmitted and new vendor files are being set up. Purchase requisitions are submitted online and routed for electronic approval, expense reports are entered, budget proposals are calculated, spreadsheets, presentations, and newsletters are pulled from the storage archive.

4:58 PM Eight hundred and twenty-six employees log off of their Local Area Networks. Remaining employees push the system for some last minute data, send out group e-mails, set up calendars and write proposals.

6:00 PM While employees crawl along in traffic, the enterprise begins automatic maintenance functions. Terabytes upon terabytes of today's



vital data is stored, protected and organized for easy access. Electronic orders from around the world increase and data storage is accessed without interruption (7 employees are still playing games on-line).

7:13 PM The sun sets, the commute ends and the SAN keeps your network operational, providing 24x7 access and reliability.

.....

Fast, efficient data access is what makes the business world go 'round. But, this exponentially increasing demand is becoming unmanageable and unaffordable for some businesses. On the horizon, however, a reverse in storage management strategy and SAN technology offers companies many new options. The SAN is a LAN-like network made up of RAID arrays, tape drives and libraries, optical drives and libraries, and storage management software that centrally manages storage capacity and takes on various related I/O processing functions. A SAN links all of the servers and clients on a LAN or on multiple LANs to centralized storage.

A SAN can be designed without any single point of failure. With proper structuring, even platform issues, file formats and other incompatibilities can be overcome and the ability to share various types of data is greatly expanded. This results in 100% uptime, lower costs and a more manageable operation. With the arrival of Fibre Channel and the needed cables and connectors, distance and speed options are dramatically improved as

well. Fibre Channel provides an ideal pipeline for a SAN, providing better scalability and higher performance than is available through traditional storage connection options.

A SAN takes the load off of the LANs it serves, assuming backup operations and freeing up bandwidth. It allows IT professionals to take a LAN server down while maintaining access to all stored data, because the files on a SAN can be accessed from any server. A SAN protects data assets by storing them centrally and yet providing high-end configuration options to map out individual access as needed. Companies can now completely customize local and/or extended networks, incrementally adding storage to the SAN as needed. Flexibility is at an all time high.

However, RAID systems and SANs go together like Microsoft and Intel. They are so interdependent that many SANs are actually built around their

RAID units. Using any one or a combination of the available levels of RAID with a SAN improves performance and data security. RAID systems provide highly expandable, reliable, redundant storage capacity. RAID controllers move and store data according to the preferences and priorities established.

A SAN properly configured with RAID has numerous benefits. In fact, RAID is fast becoming the preferred way to deploy storage on a SAN, being far more economical than having separate, dedicated storage systems. The time-intensive management of an enterprise often represents the highest portion of overall storage costs. Linking storage within a SAN and managing it with RAID will further contribute to higher productivity and lower costs.

A SAN extends the many benefits of RAID to users throughout the enterprise. This means that the fault-tolerance, high-performance and

ease-of-use features that RAID controllers provide are enjoyed by each user, regardless of their actual location in the enterprise. One of the SAN's main advantages is the ability to retain high throughput at a distance of up to 10 kilometers from users. This reach comes in handy when distant groups require access to the same secured data and when sending data to remote archiving systems.

A new kind of RAID controller, designed specifically for SAN configurations, has started to reach the marketplace. These RAID controllers with Fibre host and disk interfaces are SAN-ready. They provide high-end data integrity, accessibility and security. They scale to hundreds of MB/s and they connect terabytes upon terabytes of data. What more could you ask for?

— Suzanne S. Eaton is Sr. Marcom Manager for Mylex Corp.

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Cash And Carry

Building Portability Into A Complete Enterprise Storage Strategy

IT MANAGERS DON'T CONSIDER the potential loss of user data or users' other important data management needs when developing their enterprise storage strategy. A users' inability to exchange large files or e-mail inside and outside of the company, archive e-mail files and take large files home and on the road needs to be considered.



Kerry Brock

Enterprise data includes an organization's centralized applications such as enterprise resource planning, supply chain management, manufacturing, finance and accounting, human resources and other mission-critical applications. To accommodate an increasing volume of data, IDC reports forecast that total server storage will grow from 205,000TB in 1999 to 1.3 million terabytes by 2002. IDC analysts also expect that total worldwide server storage spending will grow to \$45 billion in 2002, from \$32.3 billion in 1999. So, most IT managers carefully consider elaborate storage and data warehouse strategies that are compatible within their technological framework.

But for every 1GB of centralized data, IDC estimates that 2GB of data is scattered in departments and even more is out on desktop and laptop computers. That data is usually not directly tied to the organization's mission but still supports critical func-

tions. In a survey by Market Trends, on a scale of 1-10, 90 percent of department managers rated the value of desktop user data a 7 or higher.

Eighty-two percent of these department managers said backup of end-user data was important to the organization. Therefore, a complete enterprise storage strategy considers the security of both centralized enterprise data and employee or end-user data.

Many corporations, however, do not consider the potential loss of user data or other important user data management needs, when developing their enterprise storage strategy. The potential for losing data (potentially hundreds of hours of work and untold cost of critical data) and the large costs associated with it mandates an immediate solution.

In addition, users' inability to perform basic tasks critical to their productivity (exchanging large files or e-mail inside and outside of the company, archiving e-mail files, carrying large files home and on the road, etc.)

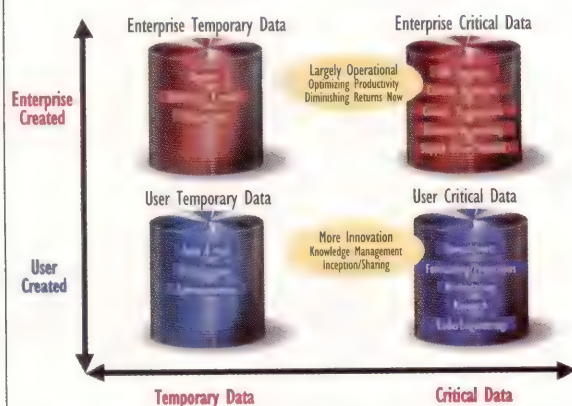
needs to be considered in planning an enterprise storage strategy.

But if employee data management were easy to accomplish, it would be happening more often. Only 49 percent of IT managers in the Market Trends survey responded that their users backed everything up to the network. Protecting and managing an individual's data is a tough job and many obstacles hinder the process. For example, network backup is often complicated and inconvenient. And users fear that once data is backed up to the network, they will never see it again.

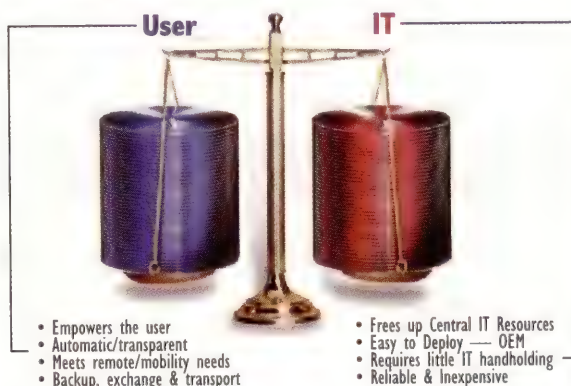
And only 41 percent of laptops or other remote PCs get their data backed up on a regular basis, an indication that most current solutions don't work well for laptop users or remote sites. Also, many organizations have not provided a reasonable way to transfer and carry large files. Standard 1.44MB diskettes can't handle the size of today's files and e-mail attachments are often limited by corporate policy.

According to the Market Trends research, the average file size limit is

Value of PC User Data



Requires a Solution That...



11MB. Also, the length of time e-mail remains on the server before being deleted is, on average, just over two months, indicating that most organizations do not provide an easy, if any way at all, to archive e-mail files.

The ideal solution, of course, is to house everything on a central network server. But it just doesn't happen. Some users will always store their data files on the desktop hard drive. And some users need to take files away from the network occasionally either to work at home or on the road. In reality, users like to have access to e-mail messages, even beyond three to six months. That's where portable storage helps to protect and transport these files away from the network.

As a complement to network storage, portable storage products help users manage their own data, simply, inexpensively and without a lot of technical support. On the other hand, according to IDC research, portable storage increases employee productivity by decreasing data recovery time in case of system problems and creating additional work hours by ensuring data is always available.

For example, portable data on hard drives can be password protected to prevent unauthorized use of the disk or its files in the event the disk is misplaced or stolen. And users can securely lock their disks in a file cabinet or briefcase by simply removing them to a separate location when a backup is complete.

Portable storage, which includes both optical and magnetic drives and

disks in a range of capacities, protect organizations from data loss, allow for greater mobility of data and easy archiving of e-mail messages. With their low acquisition cost and versatility, portable storage solutions comple-

ment network storage and round out an enterprise storage strategy.

Kerry Brock is Director for Enterprise & OEM Marketing at Imega Corp.

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Find Is Where The Action Is

IN THIS THIRD and final column in the series on the `find` command, we will look at the other action options. In the first part of this series, I proposed that a `find` synopsis line

should be written as follows:

```
find <where> <what> <action>
```

In previous columns we have discussed the available `<where>` and `<what>` options. In all the examples we used the `-print` option as our action. For example:

```
find . -name
test -print
```

This will search the current directory (where to look) for any object named `test` (what qualifies), and print the pathnames (the action) to those objects.

In addition to `-print`, there's also a way to execute commands against the objects that are qualified.

The `-exec` option allows you to specify a command line to be executed for each qualified object found. Looking only at the `-exec` option makes it easier to figure out how to use it:

```
-exec command \;
```

Note that this option takes a command as an argument. The command is essentially "piped" as a text string to a shell for execution, once for each qualified object. Because `find` might qualify more than one object, you must follow the com-

mand with a semicolon so that the shell knows where a command ends. Note that the semicolon must be escaped, since you don't want the shell that `find` is executed in to interpret it, you want `find` to "see" the semicolon.

Another very important symbol to the `-exec` option is braces. You put a set of braces in the command wherever you want `find` to place the pathname of the currently qualified object.

For example, if you used `-exec` as follows:

```
find . -name test -exec ls -l {} \;
```

if two objects were found named `test`, `find` would send something like this to a shell for execution:

```
ls -l ./survey/test ; ls -l ./backup/test ;
```

You can see why the semicolon is needed to separate the two commands.

Actually, there is no real distinction between `<what>` and `<action>` type options to `find`. It is more in how you use them.

```
find . -name test -print
```

prints all objects named `test`. The man page states that the `-print` option is always true. The meaning only becomes clear if you write something like this:

```
find . -name test -print -exec rm {} \;
```

This command prints qualified

pathnames, and because the `-print` option returns a true, the boolean expression continues, so that the `-exec` option is also executed, deleting files named `test`. If there were two objects, one is a file, the other a directory, we might get the following output:

```
./backup/test
rm: ./backup/test directory
./survey/test
```

because you cannot `rm` a directory.

If we reversed the order of the options: we get a better (more correct) result:

```
find . -name test -exec rm {} \; -print
```

we get a better (more correct) result:

```
rm: ./backup/test directory
./survey/test
```

Now the list only includes the files for which the `-exec` worked (though we get an error message from `rm` about those objects it could not remove). We can get rid of the error message with better qualifying:

```
find . -name test -type f -exec rm
{} \; -print
```

This command now reads something like: "print the names of files deleted that have the name `test`." If the file cannot be deleted, the pathname will not be `-print'd` (but you will get an error if the command `-exec'd` generates one).

An example of when you might want to use `-print` before `-exec` (instead of after):



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Another very important symbol to the **-exec** option is braces. You put a set of braces in the command wherever you want **find** to place the pathname of the currently qualified object. The **-ok** option is similar to **-exec**, except that it prompts and waits for an ok before executing the command.

```
find . -name test -type f -print -exec
cat {} \;
```

TO -EXEC OR TO NOT -EXEC

The **-ok** option is similar to **-exec**, except that it prompts and waits for an ok before executing the command:

```
% find . -name test -ok cat {} \;
< cat ... ./test >? y
hi from this dir
< cat ... ./survey/test >? n
%
```

This is a rather useful option if you are issuing a destructive command such as **rm**, and cannot perfectly qualify objects to be acted on.

Find also makes a nice front end to **cpio**. You can develop any number of qualifiers, then supply the **-cpio** option and have those objects written to the supplied device:

```
find /design -user fredm -cpio
/dev/rmt/s0d0
```

Because we now know that **find** pipes command lines to a shell for execution, it is rather obvious that something like this:

```
find . -name "*.bak" -exec rm {} \;
```

could result in many processes being created. If we tried this in a korn shell, it might work, but only if

there were not that many files found by **find**. If there were lots of them, we would have probably exceeded maximum string length, and gotten an error.

The solution is a simple one. Pipe the output of **find** to **xargs**. The **xargs** command understands maximum string length, and makes sure it does not exceed it. Here is an example:

```
find . -name "*.bak" | xargs rm
```

In this case, **xargs** makes sure that the **rm** command is fed as many filenames as possible without exceeding maximum string length.

Many people write a script or program when **find** would have performed the job easily. In more difficult cases, **find** does not have enough qualifying options to do exactly what people might need done. Well, if you really understand the discussion above about **-exec**, you should have noticed that **find** is extensible. Because all options to **find** are a boolean expression, you can use **-exec** as a qualifier, supplying a script as the command to be executed. The script must complete with 0 status (successful) if the 'test' it contains passes.

As an example, suppose we want to locate all Perl scripts on our system (and assuming they all contain "#!/usr/local/bin/perl" as the first line in the script.) If we were to use this **find** line:

```
find / -type f -perm -1 -print
```

we would end up with all owner executable files: binaries, shell and Perl scripts alike. If all Perl scripts were named ending in .pl life would be good:

```
find / -name "*.pl" -type f -perm -1
-print
```

But who names all Perl scripts that way? The solution (obviously) is to extend **find** to handle Perl scripts. I might do this with a simple shell script as follows (yeah yeah, it could have been a Perl script):

```
#!/usr/bin/ksh
head -1 $1 | grep -q '#!'
*/usr/local/bin/perl'
```

This script looks at the first line of the file passed to it as a command line argument (\$1), to see if it is a Perl script. The **grep** command returns 0 if a match is found, thus meeting the requirements of **find**. Assuming the script is in ~/bin named testit, we might try something like:

```
find / -type f -perm -1 -exec
~/bin/testit {} \; -print
```

The problem with this is one of speed. We will be opening and looking in many files, so this will take quite some time.

In the meantime, I think I'll go look for my cell phone. ♦

Getting Down With NT's Upside

ALL GOOD IT MANAGERS know one thing: possessing the greatest technology in the world doesn't mean a thing if the systems aren't running. All great IT managers actually

do something about it. That brings us to using Windows NT for mission-critical applications. While Microsoft has made some solid progress in this area with Cluster Services for NT (see "Putting Some Luster on NT Clusters" in the July 1999 of *HP Professional*) it still has a way to go before reaching the elusive "five nines".



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actually four separate systems in the array. Two are designated as Compute Elements. These systems are bare bones machines with only a CPU and memory. The other two systems are I/O Processors, which contain network interface cards and storage devices. The four systems are connected with a propri-

etary high-speed interconnect designed by Marathon. between the I/O Processors. If a system fails, the other takes over. A RAID array on each I/O Processor can be used to provide hot-swap capability and even more redundancy.

The disk systems do not need to be identical. The I/O Processors also handle network traffic. Each one has a network interface and the registry of each uses the same MAC address for both cards. If one of the interfaces fails, the other systems on the network see the same Ethernet address and can continue without interruption.

One other important feature of an Endurance array is tolerance of site failure. In Marathon jargon, a Compute Element-I/O Processor pair are referred to as a "tuple." In other words, an Endurance array consists of two tuples. The tuple can be physically separated by up to 1.5 kilometers and connected via fiber optic cable. This allows them to be put in separate buildings on separate power grids, providing not only component failure tolerance, but site failure (power, air conditioning, etc.) tolerance as well.

FAILURE IS NOT AN OPTION

5nines:5minutes (HP's term for it) or 99.999% uptime (which translates to 5.256 minutes of unscheduled downtime) is a very demanding standard. A system must not have any single point of failure. If a failure does occur, the system must be able to continue processing without data loss. The system must be repaired while it operates. Once repaired, the system must transparently return to its original state.

While these four concepts are easy to repeat, they're not so easy to implement. According to a report released by the Harvard Research Group (hrgresearch.com), only one system meets these criteria while running Windows NT: the Endurance 4000 from Marathon Technologies (marathontechnologies.com).

The Marathon Endurance product is designed primarily with off-the-shelf components: standard Windows NT software and industry standard Intel-based hardware. Endurance is an array of systems that appear as a single system to end-users. There are

etery high-speed interconnect designed by Marathon.

The Compute Elements run all the software. Both operating system and applications are run by both compute elements simultaneously. Both Compute Elements run all the instructions. They are designed to run in "lockstep;" that is, each instruction is run on each element simultaneously. This assures that if one Compute Element fails, the other continues at the next instruction and users do not know anything has gone wrong. This "lockstep" requirement means that the Compute Elements hardware must be identical.

IF ONE SHOULD HAPPEN TO FALL

The I/O Processors handle all I/O operations including disk access and network communication. They carry out any I/O instructions, which the Compute Elements generate. Each I/O Processor contains a storage system and all data is mirrored

99.999% uptime, which translates to 5.256 minutes of unscheduled downtime, is a very demanding standard. A system must not have any single point of failure. If a failure does occur, the system must be able to continue processing without data loss.

THE NET EFFECT

In a demonstration at HP World, this highly redundant system seemed to work very well. Simply turning off various parts of the array simulated failures. For instance, turning off an I/O Processor yielded no net effect that I could determine with a streaming video playing on the system. Similarly, turning off a Compute Element caused no effect.

Just as importantly, turning the system back on caused no interruption and they rejoined the array with no intervention. It's very easy to see how any component could be repaired and returned to service quickly and easily.

HP has bundled the Marathon Endurance with its NetServer systems and offers it as the HP NetServer Assured Availability System. The system uses rack mounted NetServer LPr and LH systems in a variety of prepackaged configurations. The systems can be ordered in a single rack for a single site or in two racks to provide split-site redundancy. The prepackaged solutions feature all the necessary hardware and software components to run

your own high availability NT system.

Unfortunately high-availability is not cheap. Four systems are required. Because two of the systems can be stripped down (the Compute Elements), the cost is approximately equivalent to three systems. Additionally, four Windows NT licenses are required — one for each system. And don't forget your applications: Two licenses are required, one for each Compute Element. On top of these expenses, there is also a 10% performance penalty (according to Marathon calculations) for the various error checking and verification functions.

MAKING IT ALL UP

While all this may lead to a severe case of sticker shock, the important measure is uptime. How much does not being able to process airline tickets, run manufacturing equipment or fulfill stock trades cost a company?

In the case of E-Bay, a 22-hour downtime incident cost \$5 million in lost revenue and a 20% drop in stock price. Will your losses be as dramatic? That's up to you. ♦

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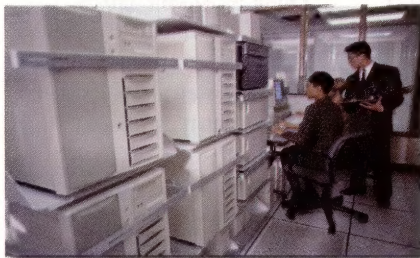
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Sometimes You Don't Know What You've Got Till It's Gone



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Get Smart And Plug Into Exchange

It's 7 a.m. on January 3, 2000 and you're sitting back drinking your first morning cup of decaffeinated coffee of the year (a New Year's resolution) thinking you dodged the

IT bullet of a lifetime and avoided any Y2K computer problems at the office. Just then the Vice President of Sales calls you and wants to know why she and the rest of her sales staff for that matter, have not been getting e-mail orders for the past week. You didn't even know this woman had your phone number let alone knew your name.

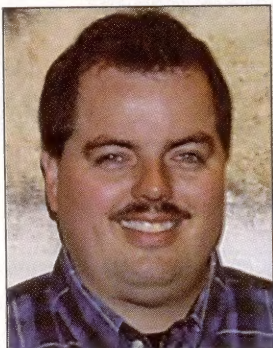
The first thing that runs through your mind is a yet-undiscovered Y2K bug. Now you're reaching for the caffeinated coffee and you remember that there were some sporadic performance problems with Microsoft Exchange prior to the holidays. There were also unsubstantiated reports of lost e-mail but no one followed up on it.

GONE BUT NOT FORGOTTEN

After an afternoon of troubleshooting your team finds an Exchange server that appears to be running, but has some elusive corruption that causes it to "eat" e-mail. The worst part is that it seems to have been doing this for over a week. Now you have to call that VP and tell her that all her e-mail is gone forever and it had nothing to do with Y2K.

The story may be fictitious. But the problem isn't. However, it's completely avoidable. HP OpenView has two products that will ensure that Microsoft Exchange problems are a

thing of the past. These products are called Microsoft Exchange plug-ins for HP OpenView ManageX and ITO. HP claims both products essentially serve the same function; just the platform is different. In the same breath they also point out that ManageX has the definite advantage over the two because it combines NT management with Exchange management.



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FROM BOTH SIDES NOW

At the heart of these Exchange plug-ins is a proactive management philosophy. No, it doesn't mean monitor logs and mail queues; and creating an event and notifying the proper technical support. It does involve using the Exchange API and drilling into the application and constantly monitoring the health of it.

Then using the inherent ability of ManageX to monitor all the different hardware pieces and multiple application parts you can correlate those events and understand the true fitness of your Exchange application.

To do all this monitoring you need to look at it from two sides: the server and the client. The server side monitors the NT information stores. These databases contain information made available to the operating system from the application. The plug-ins also interact with Exchange APIs to gather more

information not readily available in tables or logs.

This information is gathered and can be used not only for proactive fault detection but exception reporting, trending and performance planning. Use this in conjunction with the lightweight standard ManageX agent and you have a complete look at the server side of Exchange. Client side monitoring is another metric the plug-ins use to determine Exchange health.

How many times have you experienced slow client response time? The client-monitoring portion will gather statistics that are readily available to use in building, enforcing and reporting on SLA's.

TRUE LIES

The bottom line is Microsoft Exchange is a huge complex application that relies on multiple parts of your network, systems and application software. To determine its true health you need a product that can hold its own and accomplish this task. You also need a product that is open and flexible enough to fit into today's complex enterprises.

If your company uses Microsoft Exchange and doesn't have a true monitoring and management solution by all means take a look at the Exchange smart plug-ins for HP OpenView. You might also wait until February 1, 2000 to switch to decaffeinated coffee. ♦

— Charles Hebert is President of Southernview Technologies, Inc.

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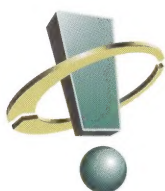
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